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Bureau of Land Management

Contract YA-512-CT7-163

Tetra Tech TC-3887

Tetra Tech, Inc.

630 North Rosemead Boulevard

Pasadena, California 91107

TD
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TETRA TECH

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6 October 1978

Bureau of Land Management
Federal Office Building, Room E-2841
2800 Cottage Way
Sacramento, CA 95825

Attention: Ms. Lois E. Payne
Contracting Officer's Authorized Representative

In re: Water Quality Monitoring, Northern California
BLM Contract YA-512-CT7-163
Tetra Tech Contract TC-3887

Dear Ms. Payne:

Presented herewith are ten (10) copies of the final report of Water Quality Monitoring, Northern California, submitted in accordance with Section 5.B(3) of the Scope of Work of the above contract. Data furnished by your office for this project are being returned under separate cover.

As a final edition the report incorporates those revisions suggested in your written review comments of 22 June 1978. This document should now be in a form that is readily useable by your District Offices.

We greatly appreciated the opportunity of assisting your organization with our services.

Respectfully submitted,

Raymond F. Rodrigue

Raymond F. Rodrigue, Ph.D.
Project Manager
Resource Sciences Department
Engineering Division

JFL-RFR:sd

cc: Robert Edgar
Denver Service Center
Contracting Officer

Enclosures: As stated above.

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ABSTRACT

Twenty inland streams under the jurisdiction of the Bureau of Land Management in northern California and northwestern Nevada were subjected to a comprehensive water quality evaluation. Field and laboratory analyses were implemented during periods of low and high water flow and utilized standard procedures to characterize specific biological, chemical, and physical parameters. Results were tabulated and compared with federal primary drinking water standards and state surface water quality objectives. All streams exceeded federal maximum contaminant levels for total coliform bacteria, with 6 streams showing very high coliform counts (over 10,000 total coliform per 100 milliliters): Badger, Bare, Bear, High Rock, Lost, and Wall. Turbidity standards were exceeded by 14 streams during periods of high flow; 7 streams were found to be above 10 nephelometric turbidity units: Badger, Bare, Butte West Branch, Hulls, Lost, Wall, and Wall Canyon. Nitrate, fluoride, and other values for all streams were well below the designated maximum contaminant levels.

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G	SELECT CALIFORNIA PLANNING BASIN WATER QUALITY OBJECTIVES
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INTRODUCTION

In June 1977 the Bureau of Land Management (BLM) authorized Tetra Tech, Inc. to conduct water quality studies of specified streams in northern California and northwestern Nevada. The investigation was administered from the BLM Denver Service Center with Contract YA-512-CT7-163. Additional direction and aid were solicited and received from BLM district offices in Ukiah, Redding, and Cedarville, California (the Surprise Resource Area headquarters within the Susanville District). Project work was initiated on June 23, 1977.

Water quality parameters of 20 of the 23 streams shown in Table 1 were sampled at locations specified by BLM district personnel (see Figure 1). Each of nine streams was sampled twice, once during the low flow period of August 22 through September 9, 1977, and again during the high flow period of March 16 through April 17, 1978. Two other streams were sampled during the low flow period only and nine streams during the high flow period only. The three remaining streams were deleted from the contract by BLM. Selections of high and low flow sampling periods were based on existing climatological data. Identical sampling and testing procedures were followed throughout the program, with analyses conducted immediately at the sampling site or, where appropriate, at the Tetra Tech water quality laboratory in Pasadena, California.

The original scope of work called for the sampling and analysis of 16 designated streams; prior to the initial field survey an additional stream was listed. During the first field investigation, scheduled for the low flow period, 6 of these 17 streams were found to be dry.

TABLE 1. *Stream Location and Water Flow When Sampled*

BLM District	*Stream*	*Stream location*		*When sampled*	
		Quadrant sheet	*USGS coordinates*	*Low flow*	*High flow*
UKIAH	Bear	Garberville	SE,SE¼,SEC 6 ,T4S,R2E	yes	yes
	Bear Canyon	Whispering Pines	SE,SE¼,SEC 25,T11N,R8W	dry	yes
	Butte S. Branch[a]	Blocksburg	SE,NE¼,SEC 2 ,T1S,R4E	no	yes
	Butte W. Branch[a]	Blocksburg	SE,NE¼,SEC 2 ,T1S,R4E	no	yes
	Cedar	Leggett	NE,NE¼,SEC 14,T23N,R17W	yes	yes
	Hulls[a]	Long Ridge	- SEC 27,T5S,R8E	no	yes
	Morrison	Ukiah	- SEC 14,T14N,R12W	dry	yes
	Nooning[a]	Briceland	SE,SW¼,SEC 31,T4S,R2E	no	yes
	Scotts[a]	Lakeport	SW,SW¼,SEC 21,T14N,R10W	no	yes
	Upper Stream Big Sulfur[b]	Lower Lake	SE,NW¼,SEC 33,T11N,R7W	dry	no
REDDING	Brock Gulch	Helena	- SEC 21,T34N,R11W	yes	yes
	Butte Forks	Paradise	NW,NW¼,SEC 26,T24N,R3E	yes	yes
	Butte Power Stn.	Paradise	NW,NW¼,SEC 10,T23N,R3E	yes	yes
	Indian[b]	Ft. Jones	SE,NE¼,SEC 3 ,T44N,R9W	yes	no

continued next page

TABLE 1 (Cont'd.). *Stream Location and Water Flow When Sampled*

BLM District	*Stream*	*Stream location*		*When sampled*	
		Quadrant sheet	*USGS coordinates*	*Low flow*	*High flow*
REDDING	Sawpit[b]	French Gulch	c	dry	no
	Slide[b]	Copco	- SEC 24,T48N,R6W	dry	no
	Willow Trib.	China Mountain	NE,SW¼,SEC 26,T42N,R7W	yes	yes
SUSANVILLE	Badger[a]	Surprise Res.[d]	- SEC 22,T38N,R19E	no	yes
	Bare	Snake Lake	NW,NW¼,SEC 15,T38N,R17E	yes	yes
	High Rock[b]	Surprise Res.[d]	- SEC 22,T40N,R23E	yes	no
	Lost	Surprise Res.[d]	- SEC 16,T37N,R20E	yes	yes
	Wall	Pinto Springs[d]	- SEC 14,T38N,R19E	yes	yes
	Wall Canyon	Surprise Res.[d]	- SEC 35,T42N,R23E	dry	yes

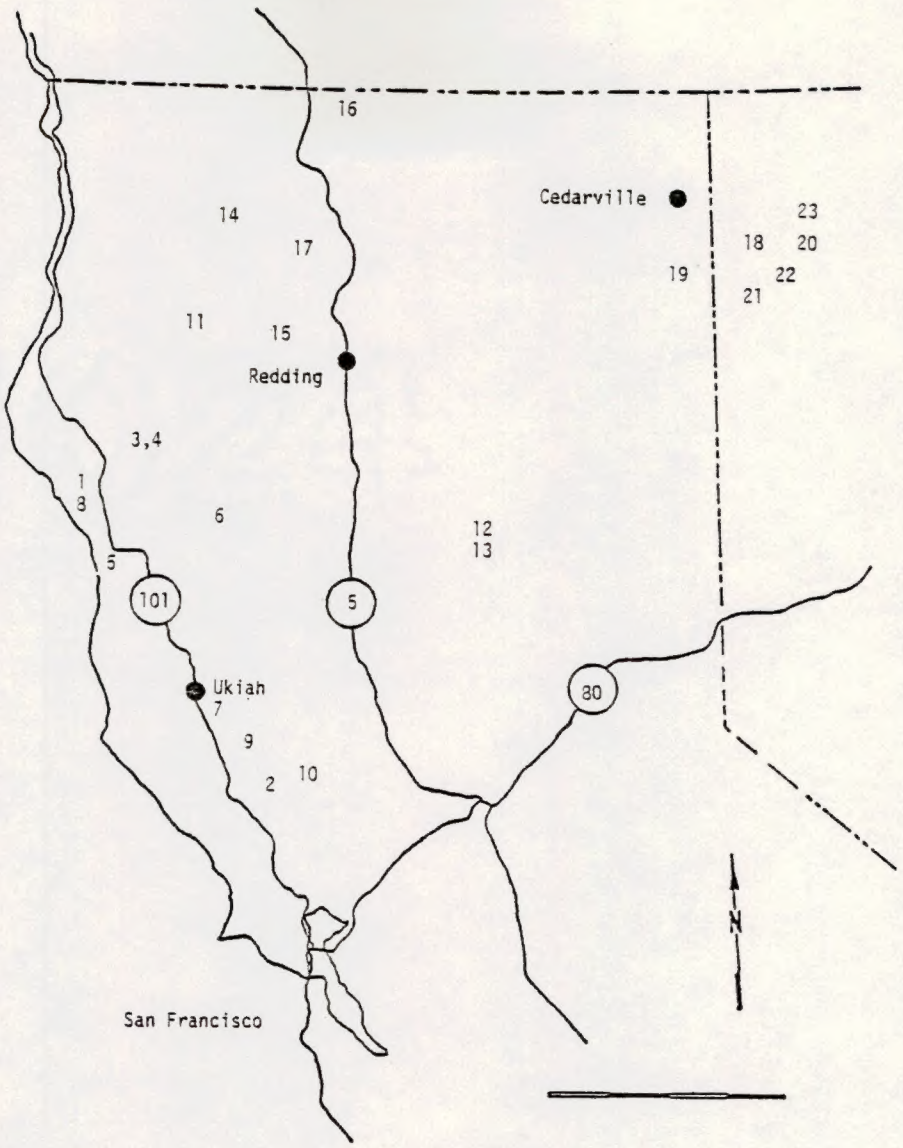
[a]Added to high flow study list per BLM's request.

[b]Deleted from high flow study list per BLM's request.

[c]Coordinates unavailable.

[d]From BLM map.

FIGURE 1. *Stream Locations*



LEGEND:

UKIAH DISTRICT

1. Bear Creek
2. Bear Canyon Creek
3. Butte Creek, South Branch
4. Butte Creek, West Branch
5. Cedar Creek
6. Hulls Creek
7. Morrison Creek
8. Nooning Creek
9. Scotts Creek
10. Big Sulfur Creek, Upper Stream

REDDING DISTRICT

11. Brock Gulch
12. Butte Creek, Forks
13. Butte Creek, Power Station
14. Indian Creek
15. Sawpit Gulch
16. Slide Creek
17. Willow Creek Tributary

SUSANVILLE DISTRICT

18. Badger Creek
19. Bare Creek
20. High Rock Creek
21. Lost Creek
22. Wall Creek
23. Wall Canyon Creek

Through various contract changes in 1978, the list of streams to be studied during the following high flow period was altered with the deletion of five streams and the addition of six others. The majority of these changes was authorized by the Denver Service Center in a communication dated January 16, 1978. Other changes were initiated by the Ukiah District Office (Mr. Bob Adams, personal communication, March 15) and by the Surprise Resource Area Office (Mr. Don Wilbur, personal communication, April 7). A summary of project expenditures is presented in Appendix A, following the text.

An interim progress report was submitted December 16, 1977 to Ms. Lois E. Payne, the Contracting Officer's Authorized Representative, at the BLM headquarters in Sacramento. That report described the work accomplished, funds expended, and special problems encountered or expected as of that time. A draft report was submitted May 31, 1978 for comments and suggestions. The present edition incorporates the suggested revisions and discusses the entire program in detail. Materials and methods utilized in this study are discussed in the next section, with an itemization of the biological, chemical, and physical parameters investigated for each stream.

The collected data are presented in the RESULTS section, organized by parameter and allowing comparisons of water quality values for low and high flow periods of each stream. The DISCUSSION section examines the data on a stream-by-stream basis, emphasizing the environmental setting and beneficial uses of each. Results are interpreted with respect to

California and Nevada surface water quality objectives, the Federal Water Pollution Control Act of 1972 (P.L. 92-500), and the Safe Drinking Water Act of 1974 (P.L. 93-523).

Several appendices follow the text to supplement discussions of methods and results. These appendices include a complete summary of project expenditures, a list of equipment utilized, details of physical measurements, a discussion of bacteria as indicators of water quality, a determination of bottom material size composition, and reproductions of appropriate federal and state water quality objectives.

MATERIALS AND METHODS

Water quality parameters of 20 streams shown in Table 1 were sampled at times and locations specified by Bureau of Land Management district personnel. All techniques for the collection and biological, chemical, and physical analyses of samples complied with published standard procedures (1,2,3,4,5,6). Table 2 shows the parameters investigated and the procedures followed. Field equipment utilized in the course of this study are itemized in Appendix B.

Biological Parameters

Benthic macroinvertebrates were collected with a Surber square-foot bottom sampler fitted with side wings to reduce the probability of specimen escape (1). One quantitative and one cumulative qualitative sample were obtained from previously undisturbed substrate areas upstream of all other sampling and measurement positions. The quantitative sample included benthic fauna inhabiting sediment, rocks, and associated vegetation within 1 square foot of streambed. The qualitative sample comprised a variable number of individual samples from other streambed locations; its purpose was to sample a variety of microhabitats in order to obtain a comprehensive inventory of macroinvertebrates present within the overall sampling area (1). Samples were immediately labeled and preserved in 10 percent by volume formalin solution. Exact counts and taxonomic classifications were subsequently made under laboratory conditions using a Wild stereoscopic microscope with 60x through 250x magnifications. Specimens were identified to order level except in cases

TABLE 2. *Parameters, Units, and Methods*

Type of Investigation	*Parameter*	*Units*	*Method*	*Reference*
BIOLOGICAL	Benthic macroinvertebrates	fauna/ft^2	Surber sample	1,5,7
	Bacteria:			
	Total coliform	bacteria/100 ml	Membrane filtration	1,8,9
	Fecal coliform			
	Fecal streptococcus			
CHEMICAL: Field Analyses	Dissolved oxygen	mg/l	Azide modification	1,4
	pH		Meter	1,2
	Alkalinity as $CaCO_3$		Sulfuric acid titration	1
	Carbonate	mg/l	Calculation	1
	Bicarbonate	mg/l	Calculation	1
	Dissolved carbon dioxide	mg/l	Calculation	4
	Conductivity	µmho	Meter	1
CHEMICAL: Lab Analyses	Total hardness as $CaCO_3$	mg/l	Calculation from atomic absorption results for Ca^{++} and Mg^{++}	1
	Total calcium Ca^{++}	mg/l	Atomic absorption	1

continued next page

TABLE 2 (Cont'd.). *Parameters, Units, and Methods*

Type of Investigation	*Parameter*	*Units*	*Method*	*Reference*
CHEMICAL: Lab Analyses	Total magnesium Mg^{++}	mg/l	Atomic absorption	1
	Total dissolved solids	mg/l	Gravimetric	1,4
	Nitrate nitrogen $NO_3^- - N$	mg/l	Brucine	1
	Total filtrable ortho-phosphate $PO_4^{\equiv} - P$	mg/l	Ascorbic acid	1
	Total filtrable ortho-phosphate $PO_4^{\equiv}$	mg/l	Ascorbic acid	1
	Chloride Cl^-	mg/l	Argentometric	1
	Fluoride F^-	mg/l	Specific ion electrometry	1
	Boron B	mg/l	Curcumin	1
	Sulfate $SO_4^{=}$	mg/l	Turbidimetric	1
	Total iron Fe^{+++}	mg/l	Atomic absorption	1
	Total copper Cu^{++}	mg/l	Atomic absorption	1
	Total zinc Zn^{++}	mg/l	Atomic absorption	1
	Total potassium K^+	mg/l	Atomic absorption	1
	Total sodium Na^+	mg/l	Atomic absorption	1

continued next page

TABLE 2 (Cont'd.). *Parameters, Units, and Methods*

Type of Investigation	*Parameter*	*Units*	*Method*	*Reference*
CHEMICAL: Lab Analyses	Silicon Si	mg/l	Atomic absorption	1
	Silica SiO_2	mg/l	Atomic absorption	1
PHYSICAL	Air temperature	°C	Mercury thermometer	
	Water temperature	°C	Mercury thermometer	
	Flow	m^3/s	Current meter	3
	Suspended sediment	mg/l	Gravimetric	1
	Suspended sediment	mg/l/s	Equal transit rate	3
	Bed load	g/min	Helley-Smith	3
	Turbidity	NTU[a]	Nephelometric	1

[a]Nephelometric turbidity units.

requiring detailed internal anatomical study, and taxa diagnostic of water quality were further identified to family (7).

Densities of total coliform, fecal coliform, and fecal streptococcus bacteria were determined using the Millipore Corporation field modifications of the standard membrane filter technique (1,8,9). Sample sizes were 0.1, 1.0, 10.0, and 25.0 ml for total coliform, and 1.0, 10.0, and 50.0 ml for fecal coliform and fecal streptococcus bacteria. The criterion for density determination was the largest sample volume with a count within the acceptable range for the type of bacteria in question (1). The acceptable ranges were:

Total coliform:	20 to 80 colonies per sample;
Fecal coliform:	20 to 60 colonies per sample; and
Fecal streptococcus:	20 to 100 colonies per sample.

Bacterial densities were calculated by the following formula:

$$\frac{\text{Number of colonies counted} \times 100}{\text{Sample size in milliliters}} = \text{Number of organisms per 100 milliliters of sample}$$

Chemical Parameters

Field Procedures

Dissolved oxygen (DO) was determined by the azide modification of the iodometric method (1). The sample was obtained from the main stream channel and care was taken to avoid trapped air or agitation. Alkaline-azide and manganous sulfate reagents were added immediately to avoid the effects of temperature change, and the volume decanted for titration

following sulfuric acid treatment was corrected for sample loss by displacement. Calculations of percent saturation of dissolved oxygen took into account the effects of temperature and altitude on oxygen solubility.

pH was measured with a Corning Model 610A expandable portable pH meter. To protect the instrument, samples were drawn from mid-channel and immediately measured. The instrument was calibrated before each use with Corning pH 7.00 prepackaged buffer solution, and 2 to 5 minutes were allowed for equilibration before the stabilized reading was recorded.

Alkalinity was determined by manual titration using the Corning Model 610A pH meter calibrated in the 4.0 to 8.5 pH range with Corning pH 4.01 and 7.00 prepackaged buffer solutions (1). The phenolphthalein alkalinity was determined, where appropriate, by titration with standardized 0.02 N sulfuric acid to pH 8.3. Total alkalinity was measured by further titration to pH 4.5. Two to five minutes were allowed for electrode equilibration in each case. Calculations were as follows:

$$\text{Phenolphthalein alkalinity as milligrams of calcium carbonate per liter} = \frac{A \times N \times 50{,}000}{\text{milliliters of sample}}$$

$$\text{Total alkalinity as milligrams of calcium carbonate per liter} = \frac{B \times N \times 50{,}000}{\text{milliliters of sample}}$$

where A = milliliters of titrant required to reach pH 8.3
B = milliliters of titrant required to reach pH 4.5
C = normality of sulfuric acid titrant

Alkalinity relationships of hydroxide, carbonate, and bicarbonate were determined from a table of stoichiometric conversions (1).

Dissolved (free) carbon dioxide concentration was calculated from the previously determined bicarbonate concentration and sample pH using the following formula as derived using known stoichiometric relationships:

$$[CO_2] = \frac{0.88}{K_1} \; 10^{-pH} \quad [HCO_3^-]$$

where,

$[CO_2]$ = concentration of carbon dioxide in milligrams per liter, as CO_2,

K_1 = ionization constant for carbonate in water (variable with temperature),

$[HCO_3^-]$ = concentration of bicarbonate in milligrams per liter, as $CaCO_3$.

This approach recognizes the dependency of free carbon dioxide upon water temperature.

Conductivity was measured directly from the stream channel with a Yellowstone Scientific Instruments Model 33 S-C-T conductivity meter and recorded as micromhos per centimeter.

Laboratory Procedures

Streamwater samples were collected in Nalgene polyethylene bottles, labeled, and immediately packed in ice within insulated ice chests. The ice was renewed daily until shipment within 4 days maximum to the Tetra Tech water quality laboratory at Pasadena, California, where all samples were analyzed immediately upon the day of arrival.

The following water quality parameters were determined and expressed as milligrams per liter of sample:

Total hardness as $CaCO_3$

Total calcium (Ca^{++})

Total magnesium (Mg^{++})

Total dissolved solids

Nitrate nitrogen (NO_3^-N)

Total filtrable orthophosphate ($PO_4^{\equiv} - P$)

Total filtrable orthophosphate as $PO_4^{\equiv}$

Chloride (Cl^-)

Fluoride (F^-)

Total boron (B)

Sulfate ($SO_4^=$)

Total iron (Fe^{+++})

Total copper (Cu^{++})

Total zinc (Zn^{++})

Total potassium (K^+)

Total sodium (Na^+)

Silicon (Si)

Silica (SiO_2)

Samples to be analyzed for total hardness and metals were preserved upon collection with concentrated nitric acid (4 milliliters per liter of sample), and the same concentration of concentrated sulfuric acid was used to preserve samples to be analyzed for nitrate. Samples analyzed for the remaining parameters were collected and cooled without preservative. Nitrate was the first parameter to be analyzed for every stream.

Major equipment used for the laboratory analyses were:

Atomic Absorption and Emission Spectrophotometer (Instrument Laboratory Model 253)

Carbon Rod Atomizer (Varian Model 63)

Ultraviolet-Visible-Infrared Spectrophotometer (Bausch and Lomb Spectronic 100)

Specific Ion Analyzer (Orion Model 470)

Support equipment included Millipore membrane filtration apparatus, drying ovens, an analytical balance, and chelating and digestion systems. Sample blanks and standards accompanied the sample unknowns in all test procedures. Quality control was maintained in conformance with established guidelines (1,2,4).

Physical Parameters

Air and water temperatures, rate of flow, bottom material size composition, bed load, suspended sediment, and turbidity were determined by standard procedures (1,3,5). Flow measurements were made at a straight portion of the stream with an even channel bottom. A tape was stretched across the stream and flow was measured at 10 to 15 even increments using either a Price or Price Pygmy meter. Discharge was later calculated and a drawing made of the channel cross-section at the measurement site. Near this point, samples of three or four representative sediment types were taken with a hand-held piston corer or shovel from the channel and banks. These were labeled and later dried, sieved, weighed, and

analyzed for size constituents. Where possible, a Helley-Smith sampler was used to determine bed load. Sketches were made of the site and stream channel configuration for later incorporation into the stream cross-section.

Suspended sediment samples were collected with a US DH-48 sampler for equal transit rate (ETR) determination; additional samples for gravimetric analysis were collected in Nalgene polyethylene bottles, packed in ice, and shipped with samples for chemical analysis to the Tetra Tech water quality laboratory within 4 days. ETR samples were analyzed by a modification of the standard filtration technique (6). Turbidity was measured directly from the stram channel with an HF Instruments DRT-15 turbidimeter following calibration with an HF Instruments reference standard.

Further details of the physical analyses conducted within this investigation are presented as Appendix C.

RESULTS

Biological Parameters (Table 3)

Extremely low populations of benthic macroinvertebrates were found in 5 streams: Morrison Creek--3 animals per square foot, high flow; Scotts Creek--0 animals per square foot, high flow; Brock Gulch--0 animals per square foot, low flow; Lost Creek--3 animals per square foot, high flow; and Wall Canyon--6 animals per square foot, high flow. Other streams supported large benthic populations, particularly Bare Creek--223 and 642 animals per square foot, low and high flows, respectively; Wall Creek--190 animals per square foot, high flow; and Badger Creek--108 animals per square foot, high flow. Large variations--possibly due to seasonally differing flow conditions or population levels--were reported for 3 streams: Brock Gulch--0 and 356 animals per square foot, low and high flows, respectively; Lost Creek--175 and 3 animals per square foot, low and high flows, respectively; and Wall Creek--9 and 190 animals per square foot, low and high flows, respectively.

Densities of total coliform bacteria ranged from 16 per 100 milliliters for Morrison Creek, high flow, to 70,000 per 100 milliliters for Bare Creek, low flow, and 76,000 per 100 milliliters for High Rock Creek, low flow. The greatest high-flow densities recorded were 15,900 and 15,200 per 100 milliliters for Lost and Badger Creeks, respectively. Fecal coliform—fecal streptococcus ratios were below 1.0 in 23 of the 29 samples analyzed, indicating livestock as the predominant source of fecal contamination in these streams. The 6 remaining ratios fell

TABLE 3. *Biological Parameters*

BLM District	Stream	Flow	Date	Benthic fauna/ft^2																	Bacteria/100 ml				
				Acarina	Amphipoda	Bivalvia	Coleoptera	Diptera	Ephemeroptera	Hemiptera	Hirudinea	Hymenoptera	Isopoda	Megaloptera	Mesogastropoda	Nematoda	Odonata	Oligochaeta	Plecoptera	Trichoptera	Total	Total coliform	Fecal coliform	Fecal streptococcus	FC/FS ratio	Probable[a] fecal source
UKIAH	Bear	low	9-07-77	0	0	0	5	0	9	0	0	0	0	5	0	0	✓	0	7	5	31	430	4	64	0.06	livestock
		high	3-28-78	0	0	0	1	3	3	0	0	0	0	0	0	0	✓	0	4	✓	11	11,400	0	850	0.00	livestock
	Bear Canyon	low																								
		high	3-20-78	0	0	0	1	3	15	0	0	✓	0	✓	0	0	0	1	1	1	22	390	2	120	0.02	livestock or wildlife
	Butte S. Branch	low																								
		high	4-01-78	0	0	0	3	0	22	0	0	0	0	0	0	0	0	0	1	1	27	600	2	32	0.06	livestock or wildlife
	Butte W. Branch	low																								
		high	4-01-78	0	0	0	6	2	30	0	0	0	0	0	0	0	0	0	15	4	57	240	8	32	0.25	livestock or wildlife
	Cedar	low	9-08-77	0	0	0	0	0	10	0	0	0	0	10	0	0	52	0	0	20	92	800	600	400	1.50	uncertain
		high	3-25-78	0	0	0	3	1	63	0	0	0	0	0	0	0	0	0	15	4	86	144	0	4	0.00	livestock or wildlife
	Hulls	low																								
		high	3-23-78	0	0	0	1	2	22	✓	0	0	0	0	0	0	1	0	5	2	33	2,460	216	136	1.59	livestock
	Morrison	low																								
		high	3-16-78	0	0	0	✓	1	1	1	0	✓	0	0	0	0	✓	0	0	0	3	16	0	0	0.00	none
	Nooning	low																								
		high	3-30-78	0	0	0	3	1	36	0	0	0	0	0	0	0	0	0	2	2	44	580	2	16	0.13	livestock or wildlife
	Scotts	low																								
		high	3-18-78	0	0	0	✓	0	0	0	0	✓	0	0	0	0	0	0	0	0	0	610	6	160	0.04	livestock or wildlife
REDDING	Brock	low	8-30-77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,140	80	220	0.36	livestock
		high	4-03-78	0	0	✓	47	16	141	0	3	0	0	0	61	13	6	25	22	22	356	3,000	0	44	0.00	livestock or wildlife

continued next page

TABLE 3 (Cont'd.). *Biological Parameters*

BLM District	Stream	Flow	Date	Benthic fauna/ft²																		Bacteria/100 ml				
				Acarina	Amphipoda	Bivalvia	Coleoptera	Diptera	Ephemeroptera	Hemiptera	Hirudinea	Hymenoptera	Isopoda	Megaloptera	Mesogastropoda	Nematoda	Odonata	Oligochaeta	Plecoptera	Trichoptera	Total	Total coliform	Fecal coliform	Fecal streptococcus	FC/FS ratio	Probable[a] fecal source
REDDING	Butte Forks	low	9-05-77	0	0	0	1	4	1	0	0	0	1	0	✓	0	0	0	5	0	12	720	60	60	1.00	livestock
		high	4-17-78	0	0	0	0	2	15	0	0	0	2	2	0	0	0	3	6	7	37	620	9	61	0.15	or wildlife
	Butte Power Stn.	low	9-05-77	b																		8,200	360	180	2.00	uncertain
		high	4-17-78	b																		6,500	4	35	0.11	livestock or wildlife
	Indian	low	8-31-77	b											✓					✓		6,100	60	390	0.15	livestock
		high																								or wildlife
	Willow Tributary	low	9-01-77				✓							✓						✓		60	60	20	3.00	livestock
		high	4-06-78	0	0	0	6	5	22	0	0	0	0	0	0	0	0	0	12	4	49	1,080	2	20	0.10	livestock
SUSANVILLE	Badger	low high	4-11-78	0	0	0	✓	✓	✓	0	0	0	0	0	0	0	0	✓	104	0	4	108	15,200	100	710	0.14	livestock
	Bare	low	8-28-77	0	0	0	20	0	200	0	6	0	0	✓	✓	0	0	0	0	0	3	223	70,000	500	160	3.13	livestock
		high	4-15-78	2		5	37	52	209	0	0	0	0		1	0	0	27	11	298	642	1,000	2	210	0.01	livestock
	High Rock	low	8-27-77	b											✓							76,000	1,000	2,000	0.50	livestock
		high																								
	Lost	low	8-26-77	0	0	0	103	0	50	20	0	0	0	0	0	0	1	0	0	1	175	3,000	560	980	0.57	livestock
		high	4-09-78	0	✓	0	2	✓	✓	0	0	0	0	0	✓	0	1	✓	0	1	3	15,900	0	94	0.00	livestock or wildlife
	Wall	low	8-25-77	0	0	0	1	0	5	0	0	0	0	0	0	0	1	0	2	0	9	12,350	260	1,400	0.19	livestock
		high	4-10-78	0	0	0	7	9	111	0	✓	0	0	0	2	0	4	18	0	39	190	5,900	4	184	0.02	livestock or wildlife
	Wall Canyon	low	4-13-78	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	6	1,900	0	156	0.00	livestock or wildlife

[a]Based on the FC/FS ratio and direct observation (8).

[b]Flow or substrate conditions did not allow Surber sample.

✓Present in qualitative sample only.

within the range of uncertain interpretation--1.0 to 4.0--and were attributed to livestock on the basis of direct observation (see Appendix D).

Chemical Parameters: Field Analyses (Table 4)

Dissolved oxygen values for the low-flow period were consistently lower than those for the high-flow period, with means of 9.0 and 10.1 milligrams per liter, respectively. The lowest recorded values were 7.4 and 7.5 milligrams per liter for the low-flow periods of the Willow Creek tributary and Wall Creek, respectively. The highest recorded value was 12.9 milligrams per liter for the highly turbulent Butte Creek (Redding District) waters sampled immediately upstream from the power station.

Values for pH ranged from 8.8 for the low-flow period of Bare Creek to 6.1 for the high-flow period of the west branch of Butte Creek (Ukiah District). Mean values for the low- and high-flow periods did not differ significantly (7.0 and 6.6, respectively).

Only one stream--Bare Creek during low flow--was sufficiently basic for alkalinity to exist as carbonate ion. Bicarbonate alkalinity was highest for the tributary of Willow Creek, with values of 344 and 288 milligrams per liter for the periods of low and high flow, respectively.

Large variations in dissolved carbon dioxide were calculated for low- and high-flow periods of five streams--Bear Creek, Brock Gulch, the Willow Creek tributary, Bare Creek, and Wall Creek--but the high and low values were not consistent with respect to the sampling period.

TABLE 4. *Chemical Parameters: Field Analyses*

BLM District	Stream	Flow	Date	Dissolved oxygen mg/l (% saturation)	pH	Alkalinity as $CaCO_3$ Carbonate mg/l	Alkalinity as $CaCO_3$ Bicarbonate mg/l	Dissolved carbon dioxide mg/l	Conductivity µmho/cm
UKIAH	Bear	low	9-07-77	8.4 (100)	6.2	0	52	65.9	179
		high	3-28-78	9.8 (94)	6.8	0	38	14.4	80
	Bear Canyon	low							
		high	3-19-78	9.5 (93)	6.8	0	96	36.8	160
	Butte S. Branch	low							
		high	4-01-78	10.8 (100)	6.6	0	36	24.2	51
	Butte W. Branch	low							
		high	4-01-78	10.8 (100)	6.1	0	34	72.9	62
	Cedar	low	9-08-77	9.3 (100)	6.6	0	88	47.7	204
		high	3-25-78	9.7 (97)	6.6	0	76	44.9	133
	Hulls	low							
		high	3-23-78	10.6 (100)	6.2	0	40	63.5	81
	Morrison	low							
		high	3-16-78	9.6 (95)	6.2	0	110	162.9	190
	Nooning	low							
		high	3-30-78	9.8 (100)	6.5	0	28	19.8	62
	Scotts	low							
		high	3-18-78	10.5 (100)	6.2	0	74	113.5	130
REDDING	Brock	low	8-30-77	10.2 (100)	7.6	0	98	5.7	230
		high	4-03-78	10.5 (95)	6.2	0	74	121.9	130
	Butte Forks	low	9-05-77	10.9 (100)	6.6	0	44	27.0	82
		high	4-17-78	10.9 (100)	6.3	0	32	41.8	47
	Butte Power Stn.	low	9-05-77	9.4 (100)	6.4	0	60	50.4	172
		high	4-17-78	12.9 (100)	6.2	0	32	54.7	50
	Indian	low	8-31-77	8.5 (100)	6.9	0	80	21.4	275
		high							
	Willow Tributary	low	9-01-77	7.4 (80)	6.4	0	344	330.2	700
		high	4-06-78	11.5 (100)	8.1	0	288	6.5	370

continued next page

TABLE 4 (Cont'd.) *Chemical Parameters: Field Analyses*

BIM District	*Stream*	*Flow*	*Date*	*Dissolved oxygen mg/l (% saturation)*	*pH*	*Alkalinity as $CaCO_3$ Carbonate mg/l*	*Alkalinity as $CaCO_3$ Bicarbonate mg/l*	*Dissolved carbon dioxide mg/l*	*Conductivity µmho/cm*
SUSANVILLE	Badger	low							
		high	4-11-78	8.2 (100)	6.8	0	54	18.9	128
	Bare	low	8-28-77	10.0 (100)	8.8	28	4	0.0	128
		high	4-15-78	10.5 (100)	6.5	0	56	48.1	82
	High Rock	low	8-27-77	a	6.2	a	a	a	540
		high							
	Lost	low	8-26-77	7.9 (95)	6.5	0	15	10.7	87
		high	4-09-78	8.3 (100)	6.6	0	22	12.4	83
	Wall	low	8-25-77	7.5 (90)	8.3	0	54	0.6	152
		high	4-10-78	8.9 (100)	7.4	0	48	4.2	138
	Wall Canyon	low							
		high	4-13-78	8.8 (100)	6.7	0	38	16.4	120

[a]Poor access conditions prohibited these analyses.

Conductivities were consistently higher during periods of low flow, with mean values of 249.9 and 116.5 micromhos per centimeter for the low and high flow periods, respectively.

Chemical Parameters: Laboratory Analyses (Tables 5A and 5B)

Order-of-magnitude differences in concentrations of chemical constituents were found for different streams, but concentration variations between sampling periods for individual streams were not large in most cases. Low flow concentrations generally were higher, probably reflecting the smaller volumes of surface water existing during this period. No chemical constituent was found to be present in excessively high concentration.

Physical Parameters (Table 6)

The date for air and water temperatures, discharge rate, suspended sediment, and turbidity generally show large variations between the periods of low and high flow. Discharge rates were very low for certain streams when sampled during August or September 1977; water in these streams moved as a trickle or was present in standing pools. Excessive flow or uneven substrate prevented the measurement of discharge rate, suspended sediment by ETR, and bed load for the streams indicated. Turbidities varied greatly between sampling periods and among different streams. The highest turbidity values were recorded for Hulls Creek (>100.0 nephelometric turbidity units) and Badger Creek (66.0 nephelometric turbidity units) during the high flow period; landslips and visually obvious bank erosion were involved in both cases. The results of seive analyses for bottom materials are presented within Appendix E.

TABLE 5A. *Chemical Parameters: Laboratory Analyses*

BLM District	Stream	Flow	Date	Constituents in mg/l: Total hardness as $CaCO_3$	Total calcium Ca^{++}	Total magnesium Mg^{++}	Total dissolved solids	Nitrate nitrogen NO_3^--N	Total filtrable o-phosphate $PO_4^{\equiv}$—P	Total filtrable o-phosphate as $PO_4^{\equiv}$	Chloride Cl^-	Fluoride F^-
UKIAH	Bear	low	9-07-77	61.9	18.8	3.6	75	0.42	0.06	0.18	4.1	0.15
		high	3-28-78	35.0	9.6	2.7	67	<0.1	0.05	0.15	3.5	<0.1
	Bear Canyon	low										
		high	3-19-78	99.1	8.0	19.2	115	<0.1	0.01	0.03	3.1	<0.1
	Butte S. Branch	low										
		high	4-01-78	33.6	5.3	4.9	54	0.1	0.03	0.09	2.0	<0.1
	Butte W. Branch	low										
		high	4-01-78	36.8	7.3	4.5	51	0.12	0.04	0.12	1.0	<0.1
	Cedar	low	9-08-77	105.0	7.8	20.8	102	<0.1	0.02	0.06	9.6	0.13
		high	3-25-78	83.2	4.3	17.6	99	<0.1	0.03	0.09	3.5	<0.1
	Hulls	low										
		high	3-24-78	45.9	9.2	5.6	86	<0.1	0.04	0.12	3.1	<0.1
	Morrison	low										
		high	3-16-78	114.0	12.8	19.8	142	0.1	0.03	0.09	4.9	0.12
	Nooning	low										
		high	3-30-78	20.5	4.6	2.2	46	<0.1	0.07	0.21	3.1	<0.1
	Scotts	low										
		high	3-18-78	62.7	13.1	7.3	95	<0.1	0.03	0.09	3.8	0.12
REDDING	Brock	low	8-30-77	141.0	34.1	13.5	164	0.12	0.04	0.13	1.6	0.15
		high	4-03-78	90.3	20.4	9.6	113	<0.1	0.05	0.15	2.3	<0.1
	Butte Forks	low	9-05-77	45.4	9.3	5.4	66	<0.1	0.04	0.12	1.6	0.11
		high	4-17-78	18.4	1.3	3.7	37	<0.1	<0.01	<0.03	1.1	<0.1

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TABLE 5A (Cont'd.). *Chemical Parameters: Laboratory Analyses*

BLM District	Stream	Flow	Date	Constituents in mg/l: Total hardness as $CaCO_3$	Total calcium Ca^{++}	Total magnesium Mg^{++}	Total dissolved solids	Nitrate nitrogen NO_3^--N	Total filtrable o-phosphate $PO_4^{\equiv}$	Total filtrable o-phosphate as $PO_4^{\equiv}$	chloride Cl^-	fluoride F^-
REDDING	Butte Power Stn.	low	9-05-77	51.8	11.3	5.7	92	0.41	0.02	0.06	3.8	0.11
		high	4-17-78	17.6	1.9	3.1	25	< 0.1	0.02	0.06	1.4	< 0.1
	Indian	low	8-31-77	157.0	44.0	11.4	183	0.15	0.15	0.46	1.2	0.15
		high										
	Willow Tributary	low	9-01-77	507.0	46.1	95.2	500	0.27	0.04	0.12	1.6	0.12
		high	4-06-78	349.0	16.4	74.8	364	0.28	0.02	0.06	2.9	< 0.1
SUSANVILLE	Badger	low										
		high	4-11-78	23.8	1.5	4.9	158	0.98	0.77	2.36	4.2	0.11
	Bare	low	8-28-77	43.6	8.7	5.3	98	0.53	0.19	0.58	1.5	0.12
		high	4-15-78	30.1	2.7	5.7	80	< 0.1	0.09	0.26	0.8	< 0.1
	High Rock	low	8-27-77	120.0	31.4	10.2	450	0.59	1.72	5.27	19.0	1.61
		high										
	Lost	low	8-26-77	11.1	3.4	0.6	80	0.72	0.02	0.06	5.2	0.25
		high	4-09-78	9.1	0.2	2.1	115	1.68	0.20	0.61	6.1	0.13
	Wall	low	8-25-77	32.9	7.4	3.3	174	0.66	0.11	0.34	6.3	0.46
		high	4-10-78	14.8	0.4	3.3	156	0.33	0.17	0.52	5.8	0.34
	Wall Canyon	low										
		high	4-13-78	14.2	1.4	2.6	109	0.48	0.31	0.95	7.4	0.18

TABLE 5B. *Chemical Parameters: Laboratory Analyses*

BLM District	*Stream*	*Flow*	*Date*	*Constituents in mg/l*								
				Total boron B	*Sulfate $SO_4^=$*	*Total iron Fe^{+++}*	*Total copper Cu^{++}*	*Total zinc Zn^{++}*	*Total potassium K^+*	*Total sodium Na^+*	*Silicon Si*	*Silica SiO_2*
UKIAH	Bear	low	9-07-77	0.17	22.0	0.01	<0.002	0.002	0.99	7.25	6.1	13.0
		high	3-28-78	0.06	9.2	<0.002	<0.002	0.005	1.28	4.80	6.4	13.7
	Bear Canyon	low										
		high	3-19-78	0.12	4.6	<0.002	<0.002	0.002	0.56	2.80	10.8	23.1
	Butte S. Branch	low										
		high	4-01-78	0.06	6.5	0.42	<0.002	<0.0005	1.35	1.90	4.9	10.5
	Butte W. Branch	low										
		high	4-01-78	0.04	8.2	0.74	<0.002	0.002	1.68	2.80	5.2	11.1
	Cedar	low	9-08-77	0.02	1.9	0.01	<0.002	0.001	0.90	5.07	6.2	13.2
		high	3-25-78	0.03	1.6	0.02	<0.002	0.001	1.88	2.90	8.4	18.0
	Hulls	low										
		high	3-24-78	0.03	12.2	1.34	<0.002	0.003	1.17	3.00	8.3	17.8
	Morrison	low										
		high	3-16-78	0.16	14.0	0.08	<0.002	0.006	1.40	6.20	9.6	20.5
	Nooning	low										
		high	3-30-78	0.06	3.1	<0.002	<0.002	0.002	1.24	5.00	7.4	15.7
	Scotts	low										
		high	3-18-78	0.18	6.8	0.08	<0.002	0.002	0.96	6.00	11.2	24.0
REDDING	Brock	low	8-30-77	0.27	6.0	5.25	<0.002	0.010	0.92	4.50	17.8	38.1
		high	4-03-78	0.06	3.1	<0.002	<0.002	<0.0005	1.44	3.10	9.0	19.2
	Butte Forks	low	9-05-77	<0.01	<1.0	0.08	<0.002	<0.0005	0.90	2.32	18.8	40.2
		high	4-17-78	0.09	<0.1	<0.002	<0.002	<0.0005	0.99	2.20	14.4	30.8

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TABLE 5B (Cont'd.). *Chemical Parameters: Laboratory Analyses*

BLM District	*Stream*	*Flow*	*Date*	*Constituents in mg/l*								
				Total boron B	*Sulfate $SO_4^=$*	*Total iron Fe^{+++}*	*Total copper Cu^{++}*	*Total zinc Zn^{++}*	*Total potassium K^+*	*Total sodium Na^+*	*Silicon Si*	*Silica SiO_2*
REDDING	Butte Power Stn.	low	9-05-77	0.24	6.1	0.02	<0.002	<0.0005	0.86	5.87	12.6	26.8
		high	4-17-78	0.06	0.6	0.01	<0.002	<0.0005	0.93	2.40	8.5	18.2
	Indian	low	8-31-77	0.33	5.3	0.05	<0.002	0.001	0.90	4.00	11.0	23.5
		high										
	Willow Trib.	low	9-01-77	0.37	31.6	0.04	<0.002	0.007	2.40	3.37	29.8	63.7
		high	4-06-78	0.06	18.7	<0.002	<0.002	0.005	3.00	1.80	16.6	35.5
SUSANVILLE	Badger	low										
		high	4-11-78	0.08	9.0	6.00	0.004	0.008	5.38	10.80	24.1	51.6
	Bare	low	8-28-77	0.05	8.3	0.80	<0.002	0.002	1.30	6.24	21.8	46.6
		high	4-15-78	0.14	4.3	1.32	<0.002	<0.0005	3.28	5.60	16.8	35.9
	High Rock	low	8-27-77	0.32	60.4	0.25	<0.002	0.010	18.00	87.10	36.9	78.9
		high										
	Lost	low	8-26-77	0.02	9.5	0.45	<0.002	0.002	1.01	9.62	26.8	57.3
		high	4-09-78	0.07	10.4	1.20	<0.002	0.003	3.68	9.30	18.6	39.8
	Wall	low	8-25-77	0.05	12.0	1.07	<0.002	0.004	6.80	20.10	35.2	75.3
		high	4-10-78	0.11	15.0	1.36	<0.002	0.003	8.48	17.70	21.6	46.2
	Wall Canyon	low										
		high	4-13-78	0.07	12.6	1.00	<0.002	0.001	5.38	14.90	18.6	39.8

TABLE 6. *Physical Parameters*

BLM District	*Stream*	*Flow*	*Date*	*Air temperature °C*	*Water temperature °C*	*Discharge rate m^3/s*	*Suspended sediment*		*Bed load g/min*	*Turbidity NTU* [b]
							Gravimetric mg/l	*ETR mg/l/s* [a]		
UKIAH	Bear	low	9-07-77	34.4	23.7	1.73	<1.0	0.09	0.00	0.38
		high	3-28-78	15.6	13.1	4.99	<1.0			0.72
	Bear Canyon	low								
		high	3-19-78	14.1	12.7	1.00	<1.0	0.04	0.00	1.5
	Butte S. Branch	low								
		high	4-01-78	7.2	8.1	0.52	4.0	1.18	C	9.2
	Butte W. Branch	low								
		high	4-01-78	7.2	7.7	3.14	5.0	C		14.0
	Cedar	low	9-08-77	27.7	18.9	3.61	<1.0			0.42
		high	3-25-78	24.4	14.0	7.50	<1.0	0.07		1.1
	Hulls	low								
		high	3-24-78	10.4	10.8		12.0			>100.0
	Morrison	low								
		high	3-16-78	21.5	14.2	2.14	<1.0		0.00	0.31
	Nooning	low								
		high	3-30-78	20.2	16.9	0.57	<1.0			0.44
	Scotts	low								
		high	3-18-78	21.4	12.4	10.26	<1.0	0.01	0.02	3.6
REDDING	Brock	low	8-30-77	21.1	15.2	0.00	70.0			0.80
		high	4-03-78	7.4	9.1	0.82	<1.0			0.50
	Butte Forks	low	9-05-77	15.5	12.1	0.06	<1.0			0.64
		high	4-17-78	12.7	9.2	0.63	<1.0	0.23		1.3

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TABLE 6 (Cont'd.). *Physical Parameters*

BLM District	*Stream*	*Flow*	*Date*	*Air temperature °C*	*Water temperature °C*	*Discharge rate m^3/s*	*Suspended sediment*		*Bed load g/min*	*Turbidity NTU*[b]
							Gravimetric mg/l	*ETR mg/l/s*[a]		
REDDING	Butte Power Stn.	low	9-05-77	37.8	20.2	C	<1.0	C	C	0.22
		high	4-17-78	13.9	7.6		<1.0			1.9
	Indian	low	8-31-77	27.2	19.8	0.12	<1.0			0.34
		high								
	Willow Tributary	low	9-01-77	19.4	12.8		1.0			0.60
		high	4-06-78	6.5	5.7	0.82	6.0	0.05		7.0
SUSANVILLE	Badger	low								
		high	4-11-78	16.9	17.4	4.61	91.0	5.30	0.54	66.0
	Bare	low	8-28-77	22.7	20.3	0.76	28.6			0.15
		high	4-15-78	8.0	7.5	7.60	22.0	1.41	0.07	25.0
	High Rock	low	8-27-77	21.1	17.5		9.6			0.18
		high								
	Lost	low	8-26-77	17.7	16.4	0.16	4.6			1.0
		high	4-09-78	18.8	16.6	1.48	27.0		0.13	17.0
	Wall	low	8-25-77	18.0	16.3	0.44	25.5		0.21	0.26
		high	4-10-78	14.8	18.0	1.46	25.0			20.0
	Wall Canyon	low								
		high	4-13-78	13.7	18.7	0.15	16.0		0.02	18.0

[a]Equal transit rate method (3).

[b]Nephelometer turbidity units.

[c]Where blank, flow or substrate conditions prevented measurement.

DISCUSSION

The biological, chemical, and physical data presented in the previous section offer a guide to the general water quality of the subject streams. The results reflect the limited sampling frequency of this investigation and by no means define trends in seasonal or long term water quality. This study amounts to "spot checking" and its value lies in bringing to light obvious water quality problems in the 20 investigated streams. To easily recognize such problems, collected data are compared with current federal and state standards that dictate acceptable conditions of water quality. For this study, the recorded values are examined with Federal Interim Primary Drinking Water Regulations; California Water Quality Objectives for Surface Waters of Basins 1A, 1B, 5A, and 6A; and Nevada Water Quality Standards for Class "A" Waters. This section discusses the results of such comparisons on a stream-by-stream basis, noting which constituents are in compliance or in violation of established standards. The environmental setting of each stream is also presented, including the relationships of contiguous and potentially-affected bodies of water and allowing an evaluation of water quality cause and effect.

The Federal Interim Primary Drinking Water Regulations are administered by the Environmental Protection Agency (EPA) and prescribe maximum contaminant levels for the nation's potable water supply. The EPA standards are found in the Code of Federal Regulations, Title 40 - Protection of Environment, Chapter 1 - Environmental Protection Agency, Subchapter D - Water Programs, Part 141 - National Interim Primary Drinking Water Regulations. The primary drinking water regulations are

promulgated pursuant to Section 1412 of the Public Health Service Act, as amended by the Safe Drinking Water Act of 1974 (P.L. 93-523). Further authorization for the establishment of federal drinking water regulations is provided by the Federal Water Pollution Control Act of 1972 (P.L. 92-500) (with amendments). Appendix F of this report contains complete copies of P.L. 92-500, P.L. 93-523, and Part 141 of the Title 40, Code of Federal Regulations.

The Federal Water Pollution Control Act and the Safe Drinking Water Act require each state to adopt water quality standards pursuant to its own laws and to submit these standards to EPA for approval. California and Nevada have accomplished this task with the promulgation of primary and secondary drinking water standards. In both cases, the state primary standards are identical to the federal primary standards. Secondary standards for both states pertain to contaminants which may adversely affect the odor, taste, or appearance of potable water, thereby adversely affecting the public welfare. The states are further required to re-evaluate their domestic water supplies, hold public hearings, and revise their water standards every 3 years. California has just completed such a revision and has not yet published new water quality and monitoring regulations. However, communications with State Public Health officials have confirmed California's adoption of primary standards equivalent to the federal standards.

Regulation 40 CFR 131.202, pursuant to the Federal Water Pollution Control Act Amendments, requires each state to establish water quality control plans for all basin planning areas within the state. The

California Water Resources Control Board and the Regional Water Quality Control Board have identified and studied 16 planning basins within California. For each, surface water quality objectives have been established based primarily upon the recorded beneficial uses of basin waters. These objectives vary from basin to basin; in some cases specific objectives for certain bodies of water within the basins have been promulgated. Nevada Water Laws also contain specific water pollution control regulations. Nevada waters are classified according to proximity and extent of human habitation, industrial and agricultural development, and the current beneficial uses of such waters.

The California Water Resources Control Board has established water quality objectives for each of the 16 planning basins within the state. Four of these major basins contain the 15 streams that constitute the California segment of this study. The water quality objectives for these basins are reproduced in Appendix G and are discussed further in this section. Within each basin, certain bodies of water have received special attention in the form of more stringent objectives controlling water quality. In some cases these objectives also apply to creeks and streams that are tributary to such waters. To determine which objectives are more appropriate for comparison with data collected from this study, careful consideration was given to the origin and fate of each of the subject streams. Where conflicts in objectives were noted, the more rigorous standards were applied.

Federal and state standards focus primarily on the physical parameters and chemical constituents of a stream to define water quality.

Significant information also can be gained from the study of a stream's benthic macroinvertebrate animals. The population density and composition of invertebrates inhabiting a stream will indicate environmental conditions which have predominated over the long term. This fact can show whether the results of concurrent chemical and physical analyses reflect prevailing water quality conditions or a short term fluctuation (11). Pollution-free streams allow the development of a complex ecosystem with many different kinds of animals interdependent through an intricate food chain, and with no single kind of animal predominating in number. In contrast, polluted water allow only those organisms which are able to live in the presence of the contaminants and tend to support a few predominant groups with little variety (12). Brief discussions of benthic macroinvertebrates observed for each stream and the implications of their numbers are presented here.

The environmental setting of each stream is also discussed in this section to allow further interpretation of recorded data. These discussions include brief descriptions of each basin's climate, wildlife, population, land usage, and historic water quality problems. Special attention is given to potential impacts to fish populations and water-contact recreation in subject streams. Environmental information for each basin is published within their respective Water Quality Control Plan Reports, parts of which are reproduced here for the reader's convenience.

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The following discussion evaluates the water quality of nine streams within two California Planning Basins: The North Coastal Basin - 1B and the Sacramento River Basin - 5A.

North Coastal Basin - 1B

Seven of the streams investigated in this study lie within the North Coastal Planning Basin: Bear Creek; Nooning Creek; Butte Creek, South Fork; Butte Creek, West Fork; Cedar Creek; Hulls Creek; and Morrison Creek. The North Coastal Basin covers approximately 8,570 square miles, encompassing Mendocino County, major portions of Humboldt and Sonoma Counties, and portions of four others.

Major population centers are found around Humboldt Bay and Santa Rosa. The 1970 Basin population of 291,000 is expected to increase to 513,000 by the year 2000. Urban centers will continue to grow....about half the people will live on less than 2 percent of the land, leaving a density of less than 30 persons per square mile for the remainder of the basin. Current employment tends to be in manufacturing, trade, and related services. Agricultural employment probably will decrease (15).

Precipitation over the North Coast area is higher than for any other California area. Approximately 90 percent of the precipitation occurs in the winter months, with very little rainfall in July, August, and September. The coastal climate is moderate and foggy with relatively small seasonal temperature variations; inland temperatures fluctuate more.

The North Coastal Basin provides a wealth of fish and wildlife. Dense coniferous forests and grassy or chaparral covered slopes are natural habitats for deer, elk, bear, mountain lion, furbearers, and many upland bird and mammal species. Numerous streams and rivers of the Basin contain anadromous fish, and the reservoirs support king and silver salmon, steelhead trout, green sturgeon, and American shad.

Water quality objectives for inland surface waters have been set by the California Regional Water Quality Control Board, North Coast Region, and approved by the State Water Resources Control Board and the Environmental Protection Agency. The objectives and relevant planning information were published in 1975 under the title *Water Quality Control Plan, North Coastal Basin - 1B*, much of which forms the basis for this discussion. Surface water quality objectives are reproduced in Appendix G.

Mattole River

The Mattole River Basin contains two of the streams under investigation: Bear Creek and Nooning Creek. The upper reaches of the Mattole River drainage receive the largest average quantities of annual precipitation in the North Coastal Basin. The mean annual flow of the Mattole River near Petrolia is estimated at 859,000 acre-feet. Most of the river basin is separated from the ocean by 2,500 foot high ridges. Grassland and chaparral-scrub habitats predominate on the ocean sides of these ridges, while woodland coniferous forests prevail inland. Small farms dot the basin using most of the lower drainage for pasture. A portion

of the Mattole River passes through the Humboldt Redwoods State Park in Humboldt County.

Intensive logging operations in the Mattole River drainage basin began about 1952. Since that time siltation in the watercourses has increased greatly. Debris from timber harvesting has blocked or eliminated many miles of formerly accessible or usable streams for spawning and nursery purposes. Prior to 1954, the Mattole River had a good winter steelhead fishery. Increased turbidity from logging and road construction has significantly reduced angling use during the winter steelhead season. Heavy use of hillsides by livestock has contributed to erosion in the drainage and to additional sedimentation of watercourses. Naturally high water temperatures in the summer have been increased by the destruction of riparian growth which formerly shaded much of the river.

No significant surface water development has occurred in the Mattole River region and no significant groundwater basins have been identified. Current beneficial uses of Mattole River waters include municipal and domestic water supply, agricultural supply, industrial service supply, contact and non-contact water recreation, cold freshwater habitat, wildlife habitat, and anadromous fish migration and spawning.

In addition to the water quality objectives adopted for the North Coastal Basin, the Regional Water Quality Control Board has established specific objectives for the Mattole River. They include:

Parameter	*Min.*	*90% Values*	*Median*[1]	*Max.*
Specific Conductance (micromhos)	-	300	170	-
Total Dissolved Solids (mg/l)	-	170	105	-
Dissolved Oxygen (mg/l)	7.0	7.5	10.0	-
pH	6.5	-	-	8.5

[1]*Median values are the 50 percentile values of the monthly means for a calendar year.*

SOURCE: *California Regional Water Quality Control Board, North Coast Region*

- *Bear Creek*

Bear Creek joins the Mattole River near Ettersburg in lower Humboldt County. Data collected under the present study offer a guide to the general water quality of Bear Creek, and have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. Ten of the 35 water quality parameters investigated for Bear Creek are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, conductivity, total dissolved solids, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and boron content.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100

milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. Bear Creek samples contained 430 total coliform per 100 milliliters for the low flow and 11,400 TC per 100 milliliters for the high flow period, in excess of federal standards. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

North Coastal Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of the Mattole River. "The median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 ml, nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 ml." Bear Creek meets this objective with 4 FC per 100 milliliters for the low flow and 0 FC per 100 milliliters for the high period. However, the data reflect limited sampling and require confirmation with the recommended sampling frequency. The data suggest that Bear Creek waters are safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 0.06, suggesting a predominance of livestock pollution.

Benthic fauna in Bear Creek waters were collected during both low and high flow periods. Seven Orders of animals were observed each time, with

a predominance of mayflies and stoneflies (Ephemeroptera and Plecoptera). The relatively diverse biological population suggests consistently good water quality (12).

Anadromous fish that have historically used or currently use reaches of the Mattole River System for migration and spawning include the cold-water species of king and silver salmon, steelhead trout, American shad, and green sturgeon. The extent to which Bear Creek is utilized by these fish was not determined in this study. Five of the parameters investigated for Bear Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

The eggs of trout and salmon require an abundance of oxygen as well as cool temperatures. Dissolved oxygen concentration objectives for the Mattole River have been set at a minimum of 10.0 milligrams per liter during spawning and incubation seasons and a minimum of 7.0 milligrams per liter at other times. King salmon characteristically spawn in freshwater from September through December; silver salmon from October through March; and steelhead during spring. Bear Creek data were collected in the September low flow period and the March high flow. These data indicate marginal to no impacts to fish from dissolved oxygen concentrations with values of 8.4 milligrams per liter (100 percent saturation) and 9.8 milligrams per liter (94 percent saturation), respectively.

Temperature objectives for the North Coastal Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature

alterations of receiving waters. "At no time or place shall the temperatures of any COLD water [habitat] by increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for the Mattole River have been set, but the Regional Water Quality Board has published guidelines for optimum salmon and trout temperatures. During salmon spawning the temperatures should be in the 4.5 to 13.5°C range; for egg incubation the desirable range is 5.5 to 13.5°C; and for young development, 10 to 15.5°C. Desirable temperatures for trout spawning are 2.8 to 7.8°C; temperatures for egg incubation should be 5.6 to 12.2°C; and should be from 12.8 to 15.6°C during other periods in the trout life cycle, with an acceptable limit of up to 21.1°C. Water temperatures for Bear Creek (23.7°C-low, 13.1°C-high) were taken in September and late March and are not representative of seasonal variations. However, no significant temperature problems are apparent from these data.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Bear Creek waters were well within these limits at 0.38 Nephelometric Turbidity Units (NTU) for the low flow and 0.72 NTU for the high flow period. The Regional Water Quality Control Board has established turbidity objectives for surface waters in the North Coastal Basin in an effort to minimize fish and wildlife impacts. "Turbidity shall not be increased more than 20 percent above naturally occurring background levels." High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and

recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold water species. Observations indicate that fishing success for trout and salmon drops off dramatically when turbidity reaches about 25 NTU. Turbidity in Bear Creek was observed to be well within these ranges.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 6.5 and 8.5 units, as specified by the North Coastal Basin objectives. For the Mattole River changes in normal ambient pH are limited to 0.5 units within this range. Values for Bear Creek--6.2 and 6.8 pH units for the low and high flow periods, respectively--indicate near-compatibility with these objectives.

Dissolved solids in Bear Creek were observed to be 75 milligrams per liter (low flow) and 67 milligrams per liter (high flow), which are within the objectives of 170 milligrams per liter (90% of values) and 105 milligrams per liter (median value) set for the Mattole River. Freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter. The California Department of Water Resources has monitored water quality of the Mattole River near Petrolia and has recorded dissolved solid values between 59 and 169 milligrams per liter. No federal drinking water standards are extant for dissolved solids.

Conductivity standards for the Mattole River have been set at 300 micromhos (90% values) and 170 micromhos (median). Observed values for Bear Creek are 179 micromhos (low flow) and 80 micromhos (high flow), indicating acceptable levels of ionized substances.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives for nitrate have been established for the North Coastal Basin or the Mattole River. Bear Creek's observed levels of nitrate, 0.42 milligrams per liter and less than 0.1 milligrams per liter for the respective low and high flow periods, suggest no problems in this area.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. Boron concentrations in Bear Creek were observed to be very low, with low flow values of 0.17 milligrams per liter and 0.06 milligrams per liter for the high flow.

North Coastal Basin objectives for fluoride concentrations in domestic or municipal supply have been established and are reproduced within Appendix G. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling, fluoride data for Bear Creek cannot be related to Basin objectives. However, fluoride levels were observed to be very low: 0.15 milligrams per liter and less than 0.1 milligrams per liter for the low and high flow periods, respectively.

- *Nooning Creek*

Nooning Creek joins the Mattole River about 1.7 miles west of Thorn Junction in Humboldt County. Data collected under the present study offer a guide to the general water quality of Nooning Creek, and have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. Ten of the 33 water quality parameters investigated for Nooning Creek are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, conductivity, total dissolved solids, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and boron content. Nooning Creek was added to the list of streams in January of 1978 and was investigated once during the high flow period.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Nooning Creek samples contained 580 total coliform per 100 milliliters for the high flow period, in signi- excess of the federal limits. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

North Coastal Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of the Mattole

River. "The median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 ml, nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 ml." Nooning Creek meets this objective with 2 FC per 100 milliliters for the high flow period. However, this data value reflects limited sampling and requires confirmation with the recommended sampling frequency. The data value suggests that Nooning Creek waters are safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 0.13, suggesting a predominance of livestock or wildlife pollution.

Benthic fauna in Nooning Creek were quantitatively sampled in late March during the high flow period. A numerical majority of the animals were mayflies (Order Ephemeroptera) with four other Orders also collected. A healthy level of photosynthesis is indicated by these results because mayflies are primary herbivores (14).

Anadromous fish that have historically used or currently use reaches of the Mattole River System for migration and spawning include the cold-water species of king and silver salmon, steelhead trout, American shad, and green sturgeon. The extent to which Nooning Creek is utilized by these fish was not determined in this study. Five of the parameters investigated for Nooning Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

The eggs of trout and salmon require an abundance of oxygen as well as cool temperatures. Dissolved oxygen concentration objectives for the Mattole River have been set at 10.0 milligrams per liter during spawning and incubation seasons and 7.0 milligrams per liter at other times. King salmon characteristically spawn in freshwater from September through December; silver salmon from October through March; and steelhead during spring. Nooning Creek data were collected in the March high flow period and indicate no impacts to fish from dissolved oxygen concentrations with a value of 9.8 milligrams per liter (100 percent saturation).

Temperature objectives for the North Coastal Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature alterations of receiving waters. "At no time or place shall the temperature of any COLD water [habitat] be increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for the Mattole River have been set, but the Regional Water Quality Board has published guidelines for optimum salmon and trout temperatures. During salmon spawning the temperatures should be in the 4.5 to 13.5°C range; for egg incubation the desirable range is 5.5 to 13.5°C; and for young development, 10 to 15.5°C. Desirable temperatures for trout spawning are 2.8 to 7.8°C; temperatures for egg incubation should be 5.6 to 12.2°C; and should be from 12.8 to 15.5°C during other periods in the trout life cycle, with an acceptable limit of up to 21.1°C. Water temperature of Nooning Creek (16.9°C-high flow) was taken in late March only and is not representative of seasonal variation. No significant temperature problems are apparent from this data value.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Nooning Creek waters were well within these limits at 0.44 Nephelometric Turbidity Units (NTU) for the high flow period. The Regional Water Quality Control Board has established turbidity objectives for surface waters in the North Coastal Basin in an effort to minimize fish and wildlife impacts. "Turbidity shall not be increased more than 20 percent above naturally occurring background levels." High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold water species. Observations indicate that fishing success for trout and salmon drops off dramatically when turbidity reaches about 25 NTU. Turbidity in Nooning Creek was observed to be well within these ranges.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 6.5 and 8.5 units, as specified by the North Coastal Basin objectives. For the Mattole River, changes in normal ambient pH are limited to 0.5 units within this range. The value for Nooning Creek--6.5 pH units for the high flow period--is compatible with the Basin's objectives.

Dissolved solids in Nooning Creek were observed to be 46 milligrams per liter for the high flow period which is well within the objectives of

170 milligrams per liter (90% values) and 105 milligrams per liter (median value) set for the Mattole River. Freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter. The California Department of Water Resources has monitored water quality of the Mattole River near Petrolia and has recorded dissolved solid values between 59 and 169 milligrams per liter. No federal drinking water standards are published for dissolved solids.

Conductivity standards for the Mattole River have been set at 300 micromhos per centimeter (90% values) and 170 micromhos per centimeter (median). The observed value for Nooning Creek was 62 micromhos per centimeter (high flow), indicating acceptable levels of ionized substances.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives have been established for the North Coastal Basin or the Mattole River. Nooning Creek's observed level of nitrate nitrogen, less than 0.1 milligrams per liter for the high flow period, suggests no problems in this area.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. The boron concentration in Nooning Creek was observed to be very low, with a value of 0.06 milligrams per liter for the high flow period.

North Coastal Basin objectives for fluoride concentrations in domestic or municipal supply have been established and are reproduced within Appendix G. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling, fluoride data for Nooning Creek cannot be related to Basin objectives. However, the fluoride level was observed to be very low: less than 0.1 milligrams per liter for the high flow period.

Van Duzen River

Butte Creek in Humboldt County is contained within the drainage basin of the Van Duzen River. The Van Duzen originates in the Six Rivers National Forest in Trinity County and flows in a generally northwest direction through Humboldt County. Near the town of Alton, the Van Duzen joins the Eel River with an estimated mean annual flow of 1,011,800 acre-feet.

The extreme upper reaches of this subunit (which attain elevations over 5,000 feet in places) are dominated by coniferous forest habitat with scattered areas of woodland. The middle altitudes of the Van Duzen River drainage are primarily grassland with mixed woodland and chaparral-scrub habitats. Lowland areas include grassland, some chaparral-scrub, cultivated-pasture, and urban-industrial in the floodplains. The floodplain area provides spawning gravels for anadromous fish with excellent fishing.

The upper portion of the Van Duzen flows through steep canyons and provides excellent trout fishing. Anadromous fish are blocked by natural barriers 37 and 46 miles upstream from the mouth (15). Hunting pressure in the area for deer, bear, dove, grouse, and other upland game is moderate. The river provides sport for advanced boaters in the spring and for other recreationists throughout the summer.

The Van Duzen River is probably the most turbid major tributary in the Eel River Basin. Unstable terrain, landslides, logging operations, and road construction and maintenance have contributed to this condition. Access for migratory fishes to some tributaries is blocked by log jams, debris, landslides, and natural falls and barriers. Some of the lower stretches of tributary streams become dry or intermittent in the summer and are heavily silted. Extreme warm temperatures prevail in the lower section in the summer where the flow meanders through the broad channel.

Logging on the steep slopes in the drainage has contributed to loss of salmon and steelhead spawning and nursery habitat. Poor watershed management has resulted in log jams that block access to spawning fish and sediment deposition in watercourses. Road construction in the drainage disturbs the highly erodible soils and adds to the sediment load of streams, resulting in an unproductive habitat for aquatic life. Sidecasting of debris deposited on roads eventually enters streams and adds to siltation (15).

Much of the rangeland in the drainage is grazed by livestock. In the past, rangeland was heavily grazed and contributed to erosion and

subsequent siltation of streams. Rangeland use is not as heavy now as in the past. The magnitude of erosion due to livestock use is not known (15).

In addition to the water quality objectives adopted for the North Coastal Basin, the Regional Water Quality Control Board has established specific objectives for the Van Duzen River. They include:

Parameter	*Min.*	*90% Values*	*Median*[1]	*Max.*
Specific Conductance (micromhos)	-	375	175	-
Total Dissolved Solids (mg/l)	-	200	100	-
Dissolved Oxygen (mg/l)	7.0	7.5	10.0	-
pH	6.5	-	-	8.5

[1]*Median values are the 50 percentile values of the monthly means for a calendar year.*

SOURCE: *California Regional Water Quality Control Board*

- *Butte Creek, South and West Forks*

Butte Creek joins the South Fork of the Van Duzen River near the Larabee Valley in Humboldt County. Data collected under the present study offer a guide to the general water quality of Butte Creek, and have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. The recorded values for 33 biological, chemical, and physical parameters for both the south and west forks of Butte Creek were compared with

current federal standards for community drinking water, and state/basin/river-specific surface water quality objectives. Ten of the 33 water quality parameters investigated are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, conductivity, total dissolved solids, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and boron content. The south and west forks of Butte Creek were sampled once during the spring high flow.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. Butte Creek samples contained 600 total coliform per 100 milliliters for the South Branch and 240 TC per 100 milliliters for the West Branch, in significant excess of the federal standards. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

North Coastal Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of the Van Duzen River. "The median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed

50/100 ml, nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 ml." Butte Creek meets this objective with 2 FC per 100 milliliters for the South Branch and 8 FC per 100 milliliters for the West Branch. However, the data reflect limited sampling and require confirmation with the recommended sampling frequency. The data suggest that Butte Creek waters are safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated for each fork by the ratio of fecal coliform to fecal streptococcus bacteria: 0.06 and 0.25, suggesting a predominance of livestock pollution in both branches of Butte Creek.

Benthic fauna in both forks of Butte Creek were quantitatively sampled in the high flow month of April. Both forks showed a predominance of mayflies (Order Ephemeroptera), indicating a healthy level of primary production in the creek (14). The West Branch of Butte Creek also revealed a generous number of stoneflies (Order Plecoptera), as well as beetles (Order Coleoptera) and caddisflies (Order Trichoptera).

Anadromous fish that have historically used or currently use reaches of the Van Duzen River System for migration and spawning include the cold-water species of king and silver salmon, steelhead trout, American shad, and green sturgeon. However, due to barriers on the Van Duzen River, anadromous fish do not utilize Butte Creek. Resident populations of rainbow trout have been recorded in the creek. Five of the parameters investigated for Butte Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

The eggs of trout require an abundance of oxygen as well as cool temperatures. Dissolved oxygen concentration objectives for the Van Duzen River have been set at 9.0 milligrams per liter during spawning and incubation seasons and 6.0 milligrams per liter at other times. Steelhead trout characteristically spawn in freshwater during spring. Butte Creek data were collected in the spring high flow and indicate no impacts to fish from dissolved oxygen concentrations with values of 10.8 milligrams per liter (100 percent saturation) for both the South and West Forks.

Temperature objectives for the North Coastal Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature alterations of receiving waters. "At no time or place shall the temperatures of any COLD water [habitat] be increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for the Van Duzen River have been set, but the Regional Water Quality Board has published guidelines for optimum trout temperatures. Desirable temperatures for trout spawning are 2.8 to 7.8°C; temperatures for egg incubation should be 5.6 to 12.2°C; and should be from 12.8 to 15.6°C during other periods in the trout life cycle, with an acceptable limit of up to 21.1°C. Water temperatures for Butte Creek (8.1°C-South; 7.7°C-West) were taken in early April and are not representative of seasonal variations. However, no significant temperature problems are apparent from these data.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method)

monthly average and 5 Turbidity Units average of 2 consecutive days. Butte Creek waters exceeded these limits at 9.2 Nephelometric Turbidity Units (NTU) for the South Branch and 14.0 NTU for the West Branch. The Regional Water Quality Control Board has established turbidity objectives for surface waters in the North Coastal Basin in an effort to minimize fish and wildlife impacts. "Turbidity shall not be increased more than 20 percent above naturally occcurring background levels." High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold water species. Observations indicate that fishing success for trout drops off dramatically when turbidity reaches about 25 NTU. Turbidity in Butte Creek was observed to be within these ranges.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 6.5 and 8.5 units, as specified by the North Coastal Basin objectives. For the Van Duzen River, changes in normal ambient pH are limited to 0.5 units within this range. pH values for Butte Creek--6.6 and 6.1 pH units for the South and West Forks, respectively--are at the lower end of the Basin's objectives.

Dissolved solids in Butte Creek were observed to be 54 milligrams per liter (South Fork) and 51 milligrams per liter (West Fork), which are within the objectives of 200 milligrams per liter (90% values) and 100

milligrams per liter (median value) set for the Van Duzen River. Freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter. The California Department of Water Resources has monitored water quality of the Van Duzen River near Bridgeville and has recorded dissolved solid values between 59 and 204 milligrams per liter. No federal drinking water standards are extant for dissolved solids.

Conductivity standards for the Van Duzen River have been set at 375 micromhos (90% values) and 175 micromhos per centimeter (median). Observed values for Butte Creek are 51 micromhos (South Fork) and 62 micromhos (West Fork), indicating acceptable levels of ionized substances.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives have been established for the North Coastal Basin or the Van Duzen River. Butte Creek's observed levels of nitrate, 0.1 milligrams per liter and 0.12 milligrams per liter for the respective South and West Branches, suggest no problems in this area.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. Boron concentrations in Butte Creek were observed to be very low, with South Fork values of 0.06 milligrams per liter and 0.04 milligrams per liter for the West Fork.

North Coastal Basin objectives for fluoride concentrations in domestic or municipal supply have been established and are reproduced within Appendix G. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling, fluoride data for Butte Creek cannot be related to Basin objectives. However, fluoride levels were observed to be very low: less than 0.1 milligrams per liter for both the South and West Branches.

The Butte Creek area includes approximately 1,280 acres of public domain land containing an estimated 25 million board feet of merchantable timber (1971 estimate). In 1972, the Bureau of Land Management instituted a plan for timber harvesting of the region over a 15 year period. In order to determine the long term effects of logging operations, the BLM initiated periodic water quality monitoring of Butte Creek with the collection of biological, chemical, and physical data prior to harvesting. The stream's natural characteristics were defined and subjected to seasonal examinations to include the annual range of streamflow conditions. BLM was joined in this study by the U.S. Geological Survey and the California Department of Fish and Game in an effort to maximize the benefits of multiple use management.

Approximately 25 chemical parameters in Butte Creek waters were studied several times over the last 7 years. Physical and biological data were collected also and reported as discharge rate, water temperature, sediment load, concentration of coliform bacteria, and numbers and types of benthic

macroinvertebrates. Samples were taken from a site located downstream of the confluence of Butte Creek's South and West Branches. The present study examines many of the same parameters as previous investigations of Butte Creek, but considers data taken from sample sites just upstream of the confluence. This was accomplished at the request of the Ukiah District Office to allow separate evaluations of the South and West Branches. Tables 7 and 8 present both current and historical data for Butte Creek and summarize water quality conditions for the stream since 1971.

With the initiation of timber harvesting in 1972 Butte Creek was opened to the potential of impacts from access road construction, vegetation removal, debris disposal, and equipment operation. Considering a "worst case" situation, the adverse effects of logging operations potentially include streambed siltation and increased water turbidity due to runoff and erosion of denuded soils. Siltation, in turn, commonly restricts aquatic plant growth and leads to depressed dissolved oxygen values. The removal of riparian growth from key reaches of a stream increases the amount of direct sunlight warming the streambed and leads to higher water temperatures, especially during summer months. Carelessly discarded debris from logging operations have been known to block portions of streams thereby limiting free access to fish populations. Oil and fuel spills from heavy equipment could significantly, if temporarily, alter a stream's water quality. Aquatic biota would likely be affected by any of these effects. Fish populations would be influenced by siltation, turbidity, depressed oxygen levels, increased temperatures, and waterway blockage. The benthic macroinvertebrate population would likely be altered to favor those species that are well adapted to conditions of low oxygen and high turbidity such as the earthworms and midges.

TABLE 7. *Results of Chemical Analyses, Butte Creek, Humboldt County (Sec. 35, T.IN., R.4E.)*

PARAMETER (in mg/l unless otherwise stated)	DATE AND TIME OF SAMPLING												
	9-14-71 1630	2-15-72 1600	5-31-72 1600	9-26-72 1500	2-27-73 1215	5-22-73 1115	9-26-73 0910	3-5-74 0945	5-29-74 0940	9-24-74 0910	5-20-75 0920	4-1-78 S. Branch[a] 1700	4-1-78 W. Branch[a] 1600
Alkalinity, as $CaCO_3$	102	47	74	43	33	75	72	25	72	105	56	36	34
Bicarbonate, as HCO_3	124	57	90	53	40	91	88	31	88	128	68	44	41
Boron, dissolved as B	0.07	0.03	0.05	0.15	0.02	0.04	0.07	0.13	0.04	0	0.03	0.06	0.04
Calcium, dissolved as Ca	29	13	21	17	9.3	23	22	7.2	22	30	17	5.3	7.3
Carbon dioxide, as CO_2	-	-	-	-	-	-	-	3.1	1.1	-	-	24.2[b]	72.9[b]
Carbonate, as CO_3	-	-	-	-	0	0	0	0	0	-	-	0	0
Chloride, dissolved as Cl	3.2	1.2	1.8	4.2	1.5	1.3	3.1	1.2	1.6	2.2	1.6	2.0	1.0
Conductivity (μmho/cm at 25°C)	219	96	162	141	71	164	169	61	163	224	140	51	62
Fluoride, dissolved as F	-	0.1	0.1	0.3	0.1	0.1	0.2	0.1	0.1	0.1	0.1	<0.1	<0.1
Hardness, noncarbonate as $CaCO_3$	-	-	-	-	-	-	-	2	0	0	3	0	3
Hardness, carbonate as $CaCO_3$	94	44	70	59	30	75	73	27	72	100	59	34	37
Iron, dissolved as Fe	-	0.02	0.02	0.11	0.07	0.05	0.15	0.08	0.04	0.03	0.16	0.42	0.74
Magnesium, dissolved as Mg	5.2	2.8	4.3	4.0	1.7	4.3	4.4	2.2	4.2	6.3	4.0	4.9	4.5
Nitrite plus Nitrate, as N	0.01	0.01	0	0.07	0.04	0	0.08	0.01	0.03	0	0.01	0.1[c]	0.12[c]
Oxygen, dissolved	9.2	11.3	8.0	10.5	11.0	10.9	-	12.5	10.9	10.6	12.1	10.8	10.8
pH	7.6	7.8	7.5	6.6	7.8	7.9	7.9	7.2	8.1	7.6	7.4	6.6	6.1
Residue, dissolved	127	63	95	83	50	97	99	41	94	128	76	54	51
Residue, dissolved (tons/acre-ft)	0.17	0.09	0.13	0.11	0.07	0.13	0.13	0.06	0.13	0.17	0.10	0.07	0.07
Sodium, dissolved as Na	8.5	3.0	4.8	5.3	2.9	5.3	6.3	2.0	5.8	8.3	4.0	1.9	2.8
Silica, dissolved SiO_2	9.3	9.3	10.0	5.6	9.4	10.0	9.2	9.0	8.8	8.4	8.5	10.5	11.1
Sulfate, dissolved SO_4	11.0	5.8	8.8	20.0	5.0	7.9	10.0	3.5	8.0	10.0	6.6	6.5	8.2

[a]Sampling performed upstream of Butte Creek Fork.

[b]Corrected to reflect influence of temperature on gas solubility.

[c]As nitrate-nitrogen only.

SOURCE: Bureau of Land Management

TABLE 8. *Results of Physical and Biological Analyses, Butte Creek, Humboldt County (Sec. 35, T.IN., R.4E.)*

PARAMETER	DATE AND TIME OF SAMPLING												
	9-14-71 1630	2-15-72 1600	5-31-72 1600	9-26-72 1500	2-27-73 1215	5-22-73 1115	9-26-73 0910	3-5-74 0945	5-29-74 0940	9-24-74 0910	5-20-75 0920	4-1-78 S. Branch 1700	4-1-78 W. Branch 1600
Discharge (cfs)	3.5[a]	19	5	27	43	3.2	1.4	37	4.6	0.3	1	18.3	110.5
Water temperature (°C)	19	6	16	10	6	10	9	4	9	11	5	8.1	7.7
Sediment (mg/l)	32	3	4	648	11	2	0	9	0	-	0.6	4	5
Coliform (counts/100 ml)	25	-	55	-	7	72	150	5	70	85	0	600	240
Dominant taxa	Psephenus Mayfly	Mayfly	Caddisfly Mayfly	Caddisfly Psephenus	Mayfly Stonefly	Caddisfly Mayfly Simulium	Mayfly Psephenus	Psephenus Mayfly	Caddisfly Mayfly	Mayfly Caddisfly Simulium	Mayfly Caddisfly	Mayfly	Mayfly Stonefly

[a] Estimate

SOURCE: Bureau of Land Management

Observations were made in 1978 to determine if any of the previously described degradations were manifest at Butte Creek. Conditions at the sampling sites revealed no visual evidence of adverse impacts from timber harvesting practices. Vegetation along the banks was undisturbed and continued to offer reasonable shade. Aquatic vegetation was difficult to assess due to heavy rain and swift currents at the time of sampling, but appeared to be abundant. No log jams or major debris accumulations blocked the watercourses in the vicinity of the sample sites. (No fish were observed during the 1978 visit.) Field and laboratory analyses of the South and West Branches support the conclusion that no logging-associated impacts are in evidence. As Tables 7 and 8 demonstrate, the dissolved oxygen level, sediment content, and water temperature of both branches of Butte Creek are normal for the season and streamflow conditions. Both branches supported several Orders of benthic macroinvertebrates, dominated by mayflies and stoneflies as would be expected in a healthy, unpolluted stream.

With the exception of one location, the road giving access to the timber areas did not appear to impact the watercourse. Two vehicle bridges were observed in the area: A wooden bridge spanned the South Fork just upstream of the confluence and a three-pipe earth-filled culvert bridged the main stream just below the confluence. In the heavy rains on the day of sampling this culvert was seen to be actively eroding and, in fact, washed out due to the large volume of water in the stream course. The wash out resulted in extreme siltation of the downstream waters of Butte Creek.

An attempt was made to discern any long term trends in water quality from the data listed in Tables 7 and 8. The chemical values appear quite normal and, for the most part, vary little from one season to the next. Discharge volumes and temperatures were observed to fluctuate with the seasons as expected. Conditions of similar discharge were examined to assess the effects of dilution on chemical constituents. Generally, dissolved residue concentrations were lower at discharge volumes of more than about 15 cubic feet per second and higher when discharges were less than about 5 cubic feet per second. Alkalinity, bicarbonate, conductivity, and hardness followed the dissolved residue dilutions as would be expected from the relationship of these parameters. No definitive trends in water quality resulting from logging operations are apparent from these data. If such trends exist, they are subtle and masked by the large seasonal variations in flow volumes.

Carbon dioxide values for the April 1978 visit (Table 7) vary markedly from previously collected data. As calculated from bicarbonate concentrations, pH, and temperature, these figures represent total carbon dioxide in the waters of each branch (refer to discussion on page 13). Concentrations of dissolved iron in both South and West Branches of Butte Creek have significantly increased from the 1975 investigation. The iron content of freshwater can be greatly influenced by natural sources such as igneous and sandstone rocks containing ferromagnesium micas and iron clay minerals, and man-made sources such as objects of cast iron and steel which may be in contact with the water. The levels of iron recorded in both forks of Butte Creek are enough to impart objectionable tastes and colors to food and drink, to cause turbidity, and to render Butte Creek waters unsuitable for municipal and industrial uses (16).

The recorded observations of nitrate nitrogen were also elevated in 1978 due possibly to the surface runoff of organics from the heavy rains. Values of pH for both South and West Branches indicate slightly less alkaline waters. The rainwater (usually more acidic in character) presumably influenced ambient pH levels at the time of sampling. However, values remain within the optimum range for freshwater fish.

California experienced one of its wettest seasons at this time resulting in major increases in discharge volumes (18 and 110 cubic feet per second for the South and West Forks, respectively). Significant levels of coliform bacteria were also observed at this time. Coliform bacteria from soils, organic wastes, and wildlife droppings are frequently swept into watercourses during flood conditions. Concentrations would be expected to return to normal levels as waters subside.

In conclusion, impacts specific to timber harvesting were not observed in the waters of Butte Creek at the sampling sites. The erosion of the aforementioned culvert and the subsequent siltation constitute significant adverse effects and require further attention.

South Fork Eel River

Another stream under investigation is Cedar Creek, contained within the hydrographic region of the South Fork Eel River. The Eel River hydrographic unit is the largest area within the North Coast Basin. Major tributaries of the Eel River include Outlet Creek, the South Fork, the Middle Fork, the North Fork, and the Van Duzen River. The Eel River drainage extends from Lake County northeast through Mendocino, Trinity, and Humboldt Counties. The South Fork joins the Eel River in Humboldt

County after traversing the northwest region of Mendocino County and the greater part of Humboldt State Park. The mean full natural flow of the South Fork River is 1,683,000 acre-feet per year where it joins the Eel at the town of South Fork (15).

Woodland and coniferous forest habitat predominate in the South Fork Eel River Basin although chaparral-scrub and grassland are scattered throughout. Urban areas are comparitively abundant with few large concentrations; high way 101 follows the South Fork for almost its entire length, about 70 miles. Due to the accessibility provided by this highway, the South Fork is one of the most popular fishing streams in the North Coastal Basin. This stream and its tributaries are extensively used by salmon and steelhead and some warm water species. Because of suitable gravels and flows, king salmon use the lower river for spawning.

A partial list of parks in the South Fork subunit includes: Standish-Hickery State Recreational area, Smithe Redwoods State Reserve, Richardson Grove State Park, Benbow Lake State Recreation area, Whittemore Grove, Holbrook Grove, Franklin Lane Grove, and a portion of Humboldt Redwoods State Park. In addition to thousands of recreationists, the river receives about 2,000 man-days of use per year for river running.

Water quality problems are siltation and warm summer water temperatures. Maximum water temperatures in excess of optimum ranges for salmonids presently occur through a large portion of the river, particularly in July and August. Although natural sediment loads are great, logging road construction and overgrazing are the primary causes of the excess siltation.

Many resorts along the river create localized pollution during the summer tourist season, and some algae blooms have occurred.

Timber harvesting operations, with associated roads and skid trails, have had a marked impact on fisheries resources. These activities have significantly increased natural sedimentation and resulted in log jams which block access for salmon and steelhead to ancestral spawning grounds. Debris in streams degrade water quality by lowering dissolved oxygen and generating toxic gases (15).

In addition to the water quality objectives adopted for the North Coastal Basin, the Regional Water Quality Control Board has established specific objectives for the South Fork Eel River. They include:

Parameter	*Min.*	*90% Values*	*Median*[1]	*Max.*
Specific Conductance (micromhos)	-	350	200	-
Total Dissolved Solids (mg/l)	-	200	120	-
Dissolved Oxygen (mg/l)	7.0	7.5	10.0	-
pH	6.5	-	-	8.5

[1]*Median values are the 50 percentile values of the monthly means for a calendar year.*

SOURCE: *California Regional Water Quality Control Board, North Coast Region*

- *Cedar Creek*

Cedar Creek joins the South Fork Eel at Leggett in upper Mendocino County. Data collected under the present study offer a guide to the general water quality of Cedar Creek, and have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. Ten of the 34 water quality parameters investigated for Cedar Creek are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, conductivity, total dissolved solids, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and boron content.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. Cedar Creek samples contained 800 total coliform per 100 milliliters for the low flow and 144 TC per 100 milliliters for the high flow period, in significant excess of the federal limits. However, this is to be expected because coliform are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

North Coastal Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of the South

Fork Eel River. "The median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 ml, nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 ml." Cedar Creek waters yielded 600 FC per 100 milliliters for the low flow and 0 FC per 100 milliliters for the high period. However, these data reflect limited sampling and require confirmation with the recommended sampling frequency. The data suggest that Cedar Creek waters are not safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 1.50, suggesting a predominance of livestock or wildlife pollution in the area.

Numbers of benthic animals in Cedar Creek were closely related at times of low and high flow sampling. The low flow was dominated by Order Odonata (damselflies, dragonflies) and Order Ephemeroptera (mayflies) out-numbered all others in the high flow period. Day (1958) reports that the nymphs of mayflies occupy an important place in the economy of aquatic communities. They are the "cattle" or "rabbits" of the aquatic environment, transforming plant tissue into animal (14). High levels of photosynthesis are usually required to support large numbers of mayfly nymphs; photosynthesis is also indicated by the relatively high dissolved oxygen content and low turbidity of Cedar Creek waters.

Anadromous fish that have historically used or currently use reaches of the Eel River System for migration and spawning include the cold-water

species of king and silver salmon, steelhead trout, American shad, green sturgeon, and some warm-water species. The extent to which Cedar Creek is utilized by these fish was not determined in this study. Five of the parameters investigated for Cedar Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

The eggs of trout and salmon require an abundance of oxygen as well as cool temperatures. Dissolved oxygen concentration objectives for the South Fork Eel River have been set at a minimum of 10.0 milligrams per liter during spawning and incubation seasons and a minimum of 7.0 milligrams per liter at other times. King salmon characteristically spawn in freshwater from September through December; silver salmon from October through March; and steelhead during spring. Cedar Creek data were collected in the September low flow period and the March high flow. These data indicate no impacts to fish from dissolved oxygen concentrations with values of 9.3 milligrams per liter (100 percent saturation) and 9.7 milligrams per liter (97 percent saturation), respectively.

Temperature objectives for the North Coastal Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature alterations of receiving waters. "At no time or place shall the temperature of any COLD water [habitat] be increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for the South Fork Eel River have been set, but the Regional Water Quality Board has published guidelines for optimum salmon and trout temperatures. During salmon spawning the temperatures should be in the

4.5 to 13.5°C range; for egg incubation the desirable range is 5.5 to 13.5°C; and for young development, 10 and 15.5°C. Desirable temperatures for trout spawning are 2.8 to 7.8°C, temperatures for egg incubation should be 5.6 to 12.2°C; and should be from 12.8 to 15.6°C during other periods in the trout life cycle, with an acceptable limit of up to 21.1°C. Water temperatures for Cedar Creek (18.9°C-low, 14.0°C-high) were taken in September and late March and are not representative of seasonal variations. However, no significant temperature problems are apparent from these data.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Cedar Creek waters were within these limits at 0.42 Nephelometric Turbidity Units (NTU) for the low flow and 1.1 NTU for the high flow period. The Regional Water Quality Control Board has established turbidity objectives for surface waters in the North Coastal Basin in an effort to minimize fish and wildlife impacts. "Turbidity shall not be increased more than 20 percent above naturally occurring background levels." High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold water species. Observations indicate that fishing success for trout and salmon drops off dramatically when turbidity reaches about 25 NTU. Turbidity in Cedar Creek was observed to be well within these ranges.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 6.5 and 8.5 units, as specified by the North Coastal Basin objectives. For the South Fork Eel River changes in normal ambient pH are limited to 0.5 units within this range. Values for Cedar Creek--6.6 pH units for both the low and high flow periods--fall within the Basin's objectives.

Dissolved solids in Cedar Creek were observed to be 102 milligrams per liter (low flow) and 99 milligrams per liter (high flow), which are within the objectives of 200 milligrams per liter (90% values) and 120 milligrams per liter (median value) set for the South Fork Eel River. Freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter. The California Department of Water Resources has monitored water quality of the South Fork Eel River near Miranda and has recorded dissolved solid values between 55 and 197 milligrams per liter. No federal drinking water standards are extant for dissolved solids.

Conductivity standards for the South Fork Eel River have been set at 350 micromhos (90% values) and 200 micromhos (median). Observed values for Cedar Creek are 204 micromhos (low flow) and 133 micromhos (high flow), indicating acceptable levels of ionized substances.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives have been established for the North Coastal Basin or the South Fork Eel River. Cedar Creek's observed levels of nitrate, less than 0.1

milligrams per liter for both the low and high flow periods, suggest no problems in this area.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. Boron concentrations in Cedar Creek were observed to be very low, with low flow values of 0.02 milligrams per liter and 0.03 milligrams per liter for the high flow.

North Coastal Basin objectives for fluoride concentrations in domestic or municipal supply have been established and are reproduced within Appendix G. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling, fluoride data for Cedar Creek cannot be related to Basin objectives. However, fluoride levels were observed to be very low: 0.13 milligrams per liter and less than 0.1 milligrams per liter for the low and high flow periods, respectively.

North Fork Eel River

In the extreme northern portion of Mendocino County the northwest flowing Eel River is joined by another major tributary, the North Fork Eel River. The North Fork originates in the highlands of the Six Rivers National Forest, runs southeasterly to collect the waters of Hulls Creek, then gently turns west and meanders to the Eel River. Along the last stretch, the North Fork forms the northern boundary of the Round Valley Indian Reservation as it traverses the Trinity-Mendocino County line.

In the higher elevations of the North Fork Eel River coniferous forest predominates with scattered areas of woodland. In the lower elevations woodland and chaparral-scrub with scattered areas of grassland are the most extensive habitats. Salmon runs are blocked by a natural barrier near the confluence with the Middle Fork but steelhead populate nearly the whole drainage.

The North Fork Eel River is characterized by extremely low summer flows and high water temperatures. The mean annual flow is estimated to be 438,500 acre-feet at the junction with the Eel River. As with the rest of the Eel River basin, the watershed in the North Fork has been heavily grazed by livestock, resulting in sheet erosion, sedimentation, and turbidity. Some logging has occurred in the watershed but has not been as extensive as in other parts of the basin. Future road construction in the North Fork drainage is contemplated along with accelerated timber harvesting. These activities can be extremely harmful to fish and aquatic life (15).

No water quality objectives have been developed specifically for the North Fork of the Eel River. However, waters from the North Fork and Hulls Creek, one of its tributaries, feed the main stem of the Eel River. For discussion purposes, Hulls Creek data will be compared with specific Eel River water quality objectives which include:

Parameter	*Min.*	*90% Values*	*Median*[1]	*Max.*
Specific Conductance (micromhos)	-	375	225	-
Total Dissolved Solids (mg/l)	-	275	140	-
Dissolved Oxygen (mg/l)	7.0	7.5	10.0	-
pH	6.5	-	-	8.5

[1]*Median values are the 50 percentile values of the monthly means for a calendar year.*

SOURCE: *California Regional Water Quality Control Board, North Coast Region*

- *Hulls Creek*

Hulls Creek joins the North Fork Eel River near Mina in the extreme southerly portion of Trinity County. Data collected under the present study offer a guide to the general water quality of Hulls Creek, and have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. Ten of the 32 water quality parameters investigated for Hulls Creek are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, conductivity, total dissolved solids, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and boron content. Hulls Creek was investigated only once during the study period, in the March high flow period.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. Hulls Creek samples contained 2,460 TC per 100 milliliters for the high flow period, in significant excess of the federal limits. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

North Coastal Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of the Eel River. "The median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 ml, nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 ml." Hulls Creek waters yielded 216 FC per 100 milliliters for the high flow period. However, the data value reflects limited sampling and requires confirmation with the recommended sampling frequency. The data value suggests that Hulls Creek waters may not be safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 1.59, suggesting a predominance of livestock pollution.

Hulls Creek was quantitatively sampled for benthic fauna in the March high flow period. Mayflies (Order Ephemeroptera) were observed to numerically dominate the seven collected Orders of animals in Hulls Creek. The results indicate a healthy level of primary productivity in the creek waters at the time of sampling (14).

Anadromous fish that have historically used or currently use reaches of the Eel River System for migration and spawning include the cold-water species of king and silver salmon, steelhead trout, American shad, and green sturgeon. The extent to which Hulls Creek is utilized by these fish was not determined in this study, but the North Fork Eel is reportedly closed to anadromous species and supporting resident trout. Five of the parameters investigated for Hulls Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

The eggs of trout require an abundance of oxygen as well as cool temperatures. Dissolved oxygen concentration objectives for the Eel River have been set at 10.0 milligrams per liter during spawning and incubation seasons and 7.0 milligrams per liter at other times. Steelhead trout characteristically spawn in freshwater during the spring. Hulls Creek data were collected in the March high flow and indicate no impacts to fish from dissolved oxygen concentrations with a value of 10.6 milligrams per liter (100 percent saturation).

Temperature objectives for the North Coastal Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature alterations of receiving waters. "At no time or place shall the temperatures

of any COLD water [habitat] be increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for the Eel River have been set, but the Regional Water Quality Board has published guidelines for optimum trout temperatures. Desirable temperatures for trout spawning are 2.8 to 7.8°C; temperatures for egg incubation should be 5.6 to 12.2°C; and should be from 12.8 to 15.6°C during other periods in the trout life cycle, with an acceptable limit of up to 21.1°C. Water temperature for Hulls Creek (10.8°C-high flow) was taken in late March and is not representative of seasonal variations. However, no significant temperature problems are apparent from the value.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Hulls Creek waters exceeded these limits significantly at greater than 100 Nephelometric Turbidity Units (NTU) for the high flow period. An unconfirmed report by a local resident indicated that a recent landslide into an upstream tributary was responsible for the extreme turbidity at the time of sampling.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 6.5 and 8.5 units, as specified by the North Coastal Basin objectives. For the Eel River changes in normal ambient pH are limited to 0.5 units within this range. The pH value for Hulls Creek--6.2 pH units for the high flow period--falls slightly outside the pH range specified in the Basin's objectives.

Dissolved solids in Hulls Creek were observed to be 86 milligrams per liter (high flow), which is within the objectives of 275 milligrams per liter (90% values) and 140 milligrams per liter (median value) set for the Eel River. Freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter. The California Department of Water Resources has monitored water quality of the Eel River at Scotia and has recorded dissolved solid values between 64 and 272 milligrams per liter. No federal drinking water standards are extant for dissolved solids.

Conductivity standards for the Eel River have been set at 375 micromhos per centimeter (90% values) and 225 micromhos per centimeter (median). The observed value for Hulls Creek was 81 micromhos per centimeter (high flow), indicating acceptable levels of ionized substances.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives have been established for the North Coastal Basin or the Eel River. Hulls Creek's observed level of nitrate, less than 0.1 milligrams per liter for the high flow period, suggests no problems in this area.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. The boron concentration in Hulls Creek was observed to be very low, with a value of 0.03 milligrams per liter for the high flow.

North Coastal Basin objectives for fluoride concentrations in domestic or municipal supply have been established and are reproduced within Appendix G. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling, fluoride data for Hulls Creek cannot be related to Basin objectives. However, the fluoride level was observed to be very low: less than 0.1 milligrams per liter for the high flow period.

Russian River

The Russian River Basin includes the major portion of Sonoma County and the southeastern quarter of Mendocino County, including Morrison Creek. The Russian River flows generally south-southeast for about two-thirds of its length before turning west to empty into the Pacific about 60 miles north of San Francisco. Precipitation in the Russian River region averages about 44 inches per year; runoff from the basin is estimated at 1,688,500 acre-feet annually. Summer flows in the main stem of the Russian River have been greater than natural since 1910, when flows from the Eel River were first diverted to the East Fork Russian River. Since the completion of the multipurpose Coyote Dam on the East Fork Russian River by the Corps of Engineers in 1958, summer releases have maintained a minimum flow of 125 cubic feet per second at Guerneville. Coyote Dam impounds the Eel River import in Lake Mendocino and has a storage capacity of 122,500 acre-feet.

Woodland, grassland, cultivated-pasture, and chaparral-scrub are the most extensive habitat types in this subunit. Coniferous forest is present to

a moderate degree and urban-industrial habitat is quite extensive. The Laguna de Santa Rosa is a marsh area of major importance. The California Protected Waterways Plan lists the Russian River as an extraordinary fishery waterway with premium riparian growth (15).

Fish and wildlife resources of the subunit are abundant. Most tributaries have good anadromous fish runs as does the river itself. Lake Mendocino has both warm- and cold-water species. In all, 19 species of fish are available to the sport fisherman in the Russian River subunit. Warm-water species are resident in the river and natural anadromous fish populations are augmented by Department of Fish and Game plants of hatchery-reared fish.

Wildlife resources include a higher than average deer population including European fallow deer in the upper drainage, black bear, feral pigs, quail, pigeon, and wild turkeys. Recreational areas in the subunit include Austin Creek State Recreational area, Armstrong Redwoods State Reserve, part of the Cow Mountain Hunting Access, and part of the Sonoma Coast State Beaches. In addition, the river receives up to 50,000 man days of use per year for river running.

Silt and turbidity are a problem in the river; much of the silt comes from the Eel River. Logging is not a major problem in the subunit. Highly mineralized water enters the river from many tributaries and boron comes from springs in the vicinity of the Geyser power plant. Sand and gravel removal disturbs spawning areas and adds to the silt problem.

In addition to the water quality objectives adopted for the North Coastal Basin, the Regional Water Quality Control Board has established specific objectives for the Russian River. They include:

Parameter	*Min.*	*90% Values*	*Median*[1]	*Max.*
Specific Conductance (micromhos)	-	320	250	-
Total Dissolved Solids (mg/l)	-	170	150	-
Dissolved Oxygen (mg/l)	7.0	7.5	10.0	-
pH	6.5	-	8.5	8.5

[1]*Median values are the 50 percentile values of the monthly means for a calendar year.*

SOURCE: *California Regional Water Quality Control Board, North Coast Region*

- *Morrison Creek*

Morrison Creek joins the Russian River near Ukiah in eastern Mendocino County. Data collected under the present study offer a guide to the general water quality of Morrison Creek, and have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. Ten of the 34 water quality parameters investigated for Morrison Creek are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, conductivity, total dissolved solids, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to

fecal streptococcus, and boron content. Morrison Creek was investigated only once in the course of this study during the March high flow period.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. Morrison Creek samples contained only 16 total coliform per 100 milliliters for the high flow period, in excess of the federal limits. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwwaters. Antibacterial measures are required before waters may be deemed potable.

North Coastal Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of the Russian River. "The median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 ml, nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 ml." Morrison Creek meets this objective with 0 FC per 100 milliliters for the high flow period. However, this data value reflects limited sampling and requires confirmation with the recommended sampling frequency. The data value suggests that Morrison Creek waters are safe for recreational swimming and other water-contact sports.

Benthic fauna in Morrison Creek were relatively sparse when observed during the March high flow. Six Orders of animals were observed, but only three

individuals were collected. Animals included flies (Order Diptera), mayflies (Order Ephemeroptera), and true bugs (Order Hemiptera). None of the other data suggest adverse conditions that might limit benthic populations.

Anadromous fish that have historically used or currently use reaches of the Russian River System for migration and spawning include the cold-water species of king and silver salmon, steelhead trout, American shad, and green sturgeon. The extent to which Morrison Creek is utilized by these fish was not determined in this study. Five of the parameters investigated for Morrison Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

The eggs of trout and salmon require an abundance of oxygen as well as cool temperatures. Dissolved oxygen concentration objectives for the Russian River have been set at 10.0 milligrams per liter during spawning and incubation seasons and 7.0 milligrams per liter at other times. King salmon characteristically spawn in freshwater from September through December; silver salmon from October through March; and steelhead during spring. Morrison Creek data were collected in the March high flow period. These data indicate marginal to no impacts to fish from dissolved oxygen concentrations with a value of 9.6 milligrams per liter (95 percent saturation).

Temperature objectives for the North Coastal Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature

alterations of receiving waters. "At no time or place shall the temperatures of any COLD water [habitat] be increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for the Russian River have been set, but the Regional Water Quality Board has published guidelines for optimum salmon and trout temperatures. During salmon spawning the temperatures should be in the 4.5 to 13.5°C range; for egg incubation the desirable range is 5.5 to 13.5°C; and for young development, 10 to 15.5°C. Desirable temperatures for trout spawning are 2.8 to 7.8°C; temperatures for egg incubation should be 5.6 to 12.2°C; and should be from 12.8 to 15.6°C during other periods in the trout cycle, with an acceptable limit of up to 21.1°C. Water temperature for Morrison Creek (14.2°C-high flow) was taken in March only and is not representative of seasonal variations. However, no significant temperature problems are apparent from this data value.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Morrison Creek waters were well within these limits at 0.31 Nephelometric Turbidity Units (NTU) for the high flow period. The Regional Water Quality Control Board has established turbidity objectives for surface waters in the North Coastal Basin in an effort to minimize fish and wildlife impacts. "Turbidity shall not be increased more than 20 percent above naturally occurring background levels." High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater

fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold-water species. Observations indicate that fishing success for trout and salmon drops off dramatically when turbidity reaches about 25 NTU. Turbidity in Morrison Creek was observed to be well within these ranges.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 6.5 and 8.5 units, as specified by the North Coastal Basin objectives. For the Russian River changes in normal ambient pH are limited to 0.5 units within this range. The pH value for Morrison Creek--6.2 pH units for the high flow period--falls slightly outside the range specified in the Basin's objectives.

Dissolved solids in Morrison Creek were observed to be 142 milligrams per liter (high flow), which are within the objectives of 170 milligrams per liter (90% values) and 150 milligrams per liter (median value) set for the Russian River. Freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter. The California Department of Water Resources has monitored water quality of the Russian River near Guerneville and has recorded dissolved solid values between 150 and 196 milligrams per liter. No federal drinking water standards are extant for dissolved solids.

Conductivity standards for the Russian River have been set at 320 micromhos per centimeter (90% values) and 250 micromhos per centimeter (median). The observed value for Morrison Creek is 190 micromhos per centimeter (high flow), indicating acceptable levels of ionized substances.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives have been established for the North Coastal Basin or the Russian River. Morrison Creek's observed level of nitrate, 0.1 milligrams per liter, suggests no problems in this area.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. The boron concentration in Morrison Creek was observed to be very low, with a value of 0.16 milligrams per liter for the high flow period.

North Coastal Basin objectives for fluoride concentrations in domestic or municipal supply have been established and are reproduced within Appendix G. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling, fluoride data for Morrison Creek cannot be related to to Basin objectives. However, the fluoride level was observed to be very low: 0.12 milligrams per liter.

Sacramento River Basin - 5A

Two of the Ukiah District streams lie within the Sacramento River Planning Basin: Bear Canyon Creek and Scotts Creek. As defined by the California Water Resources Control Board, Basin 5A includes the entire Sacramento River drainage upstream of the city of Sacramento. Also, it includes the closed basin of Goose Lake and the drainage basins of Cache and Putah Creeks. The California majority of the basin encompasses about 26,500 square miles, with another 720 square miles in Oregon. The principal streams are the Sacramento River and its larger tributaries--the Pit, Feather, Yuba, Bear, and American Rivers to the east with Cottonwood, Stony, Cache, and Putah Creeks draining the Coast Range mountains.

The Sacramento River Basin encompasses all or part of 20 Northern California counties, including the major population center of Sacramento. The 1970 population of the Basin was approximately 1.2 million, half of which lived in Sacramento County. The Basin portion of Lake County, wherein lies Scott and Bear Canyon Creeks, supported 19,600 persons in 1970; Butte County, containing Butte Creek, had a population of 102,000 in that year. Agriculture is a major element in the Basin economy and employment, with over 2.7 million acres of cultivated and pasture land.

The climate of the Basin varies greatly depending upon elevation and topography. In the lower valley, a two-season climate predominates with hot summers and mild winters. The average temperature ranges from 44°F (January) to 80°F (July) with a growing season of 7 to 8 months.

The mean seasonal precipitation is 23 inches, decreasing from north to south. The mountain elevations above 5,000 feet generally experience heavy winter snowfall and mild summers. Temperatures range from an average 24°F (January) to 68°F (July).

The Sacramento River Basin supports a diverse biological community. Dense coniferous forests at the higher elevations of the eastern part of the Basin provide habitat for several big game species, including deer, elk, and black bear. Hardwood forests of oak, cottonwood, and sycamore mix with chaparral to support populations of mule deer, squirrel, rabbit, coyote, and many upland bird species. Numerous streams and lakes host both warm and cold freshwater fish species, including trout, salmon, bass, bluegill, sunfish, and crappie.

Water quality objectives for inland surface waters of the Sacramento River Basin have been established by the California Regional Water Quality Control Board, Central Valley Region, and approved by the State Water Resources Control Board and the Environmental Protection Agency. The objectives and relevant planning information were published in 1975 under the title *Water Quality Control Plan Report - Sacramento River Basin (5A), Sacramento - San Joaquin Delta Basin (5B), San Joaquin Basin (5C)*, much of which forms the basis for this discussion. Surface water quality objectives are reproduced in Appendix G.

Putah Creek

Bear Canyon Creek originates in the foothills of the Mayacmas Mountains and joins Putah Creek to traverse the southern quarter of Lake County.

Putah Creek continues southeasterly into Napa County where it feeds Lake Berryessa, then heads east to Solano County.

Chaparral and hardwood forests dominate the upland habitats of the Putah Creek drainage basin, with oak, cottonwood, willow, alder, and sycamore found in the riparian reaches of the creek. Significant urban and agricultural developments influence regions near Lake Berryessa and the valley floor. Black-tailed deer, ring-necked pheasant, wild turkey, mourning doves, band-tailed pigeons, mountain and California quail are found throughout the area.

The mineral quality of waters in this region is fair to good. Total dissolved solids are generally low and the character ranges from slightly to very hard. High boron concentrations throughout the region restrict the usefulness of some waters for irrigation purposes. Algae blooms and dissolved oxygen depressions are frequent in Lake Berryessa where high turbidities also threaten domestic water supplies. Putah Creek generally has good water quality and supports a variety of warm-water and cold-water fish populations (17).

Beneficial uses of Putah Creek waters from the source to and including Lake Berryessa are listed as municipal and domestic water supply, agricultural supply, contact and non-contact recreation, warm and cold freshwater habitat, warm water species spawning, and wildlife habitat (17). No specific objectives for the water quality of the Putah Creek basin have been established by the Central Valley Regional Water Quality Control

Board. For the purposes of this discussion, data for Bear Canyon Creek were compared with those objectives set for the Sacramento River Basin which have been reproduced within Appendix G of this report.

- *Bear Canyon Creek*

Bear Canyon Creek joins Putah Creek near Anderson Springs in Lake County. Data collected under the present study offer a guide to the general water quality of Bear Canyon Creek and have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. The recorded values for the 35 biological, chemical, and physical parameters were compared with current federal standards for community drinking water, and state/basin/river-specific surface water quality objectives. Eight of the 35 water quality parameters investigated for Bear Canyon Creek are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, boron content, and total dissolved solids. Bear Canyon Creek was sampled only once during the March high flow period.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. Bear Canyon Creek samples contained 390 TC per 100

milliliters for the high flow period, in significant excess of the federal limits. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

Sacramento River Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of Bear Canyon Creek. "The fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed a geometric mean of 200/100 ml, nor shall more than 10 percent of the total number of samples taken during any 30-day period exceed 400/100 ml." Bear Canyon Creek meets this objective with 2 FC per 100 milliliters for the high flow period. However, this data value reflects limited sampling and requires confirmation with the recommended sampling frequency. The data value suggests that Bear Canyon Creek waters are safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 0.02, suggesting a predominance of livestock or wildlife pollution.

Bear Canyon Creek was sampled for benthic fauna in the high flow month of March. Eight Orders of animals were observed with Ephemeroptera (mayflies) in the majority at 15 organisms per square foot. As herbivores, the presence of Ephemeroptera in large numbers suggests correspondingly high primary productivity in Bear Canyon Creek (14). The relatively diverse benthic community gives an indication of the stream's long established and healthy water quality.

Putah Creek and its tributary streams are beneficially used by several warm water fish, including: largemouth bass, sturgeon, shad, crappie, and catfish. The extent to which Bear Canyon Creek is utilized by these fish was not determined in this study. Five of the parameters investigated for Bear Canyon Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

Warm water game species in general have less demanding oxygen requirements than cold-water fish. Concentrations of 80 to 100 percent saturation are required during the spring and summer spawning season for eggs and fry. Fingerlings and adults can exist at concentrations above 50 percent of saturation, provided the content does not drop below 5 milligrams per liter (17). Dissolved oxygen concentration objectives for waters that are especially suitable for fish spawning (including Bear Canyon Creek) have been set at a minimum of 7.0 milligrams per liter at all times. Bear Canyon Creek data indicate no impacts to fish from dissolved oxygen concentrations, with a value of 9.5 milligrams per liter (93 percent saturation) recorded in the March high flow period.

Temperature objectives for the Sacramento River Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature alterations of receiving waters. "At no time or place shall the temperatures of WARM intrastate waters be increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for Bear Canyon Creek have been set, but the Regional Water Quality Board has published guidelines for optimum temperatures for warm-water game fish. "Warm water species spawn in the spring and early summer.

Bass and sunfish need gradually rising temperatures to 60-70°F (15.6 - 21.1°C). Temperatures should remain in this range during egg incubation. Development of the young is optimum over the range of 70-85°F (21.1° - 29.4°C). Temperatures should not exceed 90°F (32.2°C). Catfish prefer temperatures at the upper portion of these ranges and yellow perch at the lower." Water temperature for Bear Canyon Creek (12.7°C) was taken in March only and is not representative of seasonal variation. It is below the published guidelines for warm water game fish, however.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Bear Canyon Creek waters were somewhat turbid at 1.5 Nephelometric Turbidity Units (NTU) for the high flow period. The Regional Water Quality Control Board has established turbidity objectives for surface waters in the Sacramento River Basin in an effort to minimize fish and wildlife impacts. "Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: where natural turbidity is between 0 and 50 Jackson Turbidity Units (equivalent to NTU), increases shall not exceed 20 percent." High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold-water species. Observations indicate that fishing success drops off dramatically when turbidity reaches about 25 NTU. Turbidity in Bear Canyon Creek was observed to be well within these ranges.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 6.5 and 8.5 units, as specified by the Sacramento River Basin objectives. In freshwaters with designated WARM beneficial uses, changes in normal ambient pH are limited to 0.5 units within this range. The observed pH value for Bear Canyon Creek--6.8 pH units for the high flow period--lies within the Basin's objectives.

While no federal or state water quality objectives control dissolved solid concentrations in the Sacramento River Basin, optimum limits have been advised by the Regional Water Quality Control Board. Freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter. Dissolved solids in Bear Canyon Creek were observed to be 115 milligrams per liter indicating no problems in this area.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives have been established for the Sacramento River Basin other than requiring that "waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses." Bear Canyon Creek's observed level of nitrate, less than 0.1 milligrams per liter for the high flow period, suggests no nitrate problems.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. The boron

concentration in Bear Canyon Creek was observed to be very low: 0.12 milligrams per liter for the high flow period.

Federal objectives for fluoride concentrations in domestic or municipal water supplies have been established and are reproduced within Appendix F. Concentration limits are set for the annual average of maximum daily air temperatures. Because air temperatures were measured only at the time of stream sampling, fluoride data for Bear Canyon cannot be related to federal objectives. However, the fluoride level was observed to be very low: less than 0.1 milligrams per liter for the high flow period.

Clear Lake

The Clear Lake region of Lake County contains one of the streams under investigation: Scotts Creek. The water level of Clear Lake is regulated by gates on a dam at the outlet, impounding a maximum volume of 319,000 acre-feet. The Clear Lake Basin encloses more than 500 square miles, draining the northeast slopes of the Mayacmas Mountains.

Dominant flora include oak, cottonwood, willow, alder, and sycamore which populate important breeding areas and feeding grounds for adjacent wildlife and waterfowl. Significant urban and agricultural influence is found near the lake. Freshwater systems in the Clear Lake region hold spawning grounds for the warm-water fish species, largemouth bass, sturgeon, and shad. Resident populations of catfish are found in Clear Lake.

Algae blooms and dissolved oxygen depressions are frequent in Clear Lake. Nutrients carried into the lake by storm drainage contribute to the

eutrophication problems in this water body. The direct discharge of municipal and industrial wastes into Clear Lake was prohibited in 1975 in an attempt to aleviate further degradation. Most of the municipal and industrial discharges in Clear Lake Basin are confined to land disposal, where evaporation, infiltration, and evapotranspiration are utilized for treatment.

Current beneficial use of Clear Lake waters include municipal and domestic water supply, agricultural supply, contact and non-contact water recreation, warm freshwater habitat, wildlife habitat, and spawning grounds for warm water fish. Water quality objectives for inland surface waters of the Sacramento River Basin have been discussed and presented in Appendix G. Scotts Creek and Clear Lake waters are subject to these objectives; no further regulations specific to the lake have been adopted.

- *Scotts Creek*

Scotts Creek originates in the Mayacmas Mountains near Lakeport in Lake County, flows northwesterly until joining with waters from the Blue Lakes, then turns southeasterly to feed Clear Lake. Data collected under the present study offer a guide to the general water quality of Scotts Creek, and have been presented in the previous section within Tables 3, 4, 5A, 5B and 6. Eight of the 35 water quality parameters investigated for Scotts Creek are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, boron content, and total dissolved solids. Scotts Creek was sampled only once during the March high flow period.

Federal drinking water limits for total coliform (TC) bacteria for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. Scotts Creek samples contained 610 total coliform per 100 milliliters for the high flow period, in significant excess of the federal limits. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

Sacramento River Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of Scotts Creek. "The fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed a geometric mean of 200/100 ml, nor shall more than 10 percent of the total number of samples taken during any 30-day period exceed 400/100 ml." Scotts Creek meets this objective with 6 FC per 100 milliliters for the high flow period. However, this data value reflects limited sampling and requires confirmation with the recommended sampling frequency. The data value suggests that Scotts Creek waters are safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 0.04, suggesting a predominance of livestock or wildlife pollution.

The biological survey of Scotts Creek indicates the stream's incapacity for supporting complex benthic communities. No benthic animals were

collected with the sampler and only two Orders were observed: Coleoptera (beetles) and Hymenoptera (bees, wasps, and ants). Scotts Creek had a gravel substrate with little evidence of organic detritus, periphyton, algae, or vascular plants. Because there was little food to support primary herbivores such as Ephemeroptera, a complex food chain could not be supported and no benthic fauna were found in the Surber sample. The Coleoptera and Hymenoptera collected non-quantitatively were aquatic adults which may have developed elsewhere. Despite the paucity of aquatic life, however, Scotts Creek had no quantitatively apparent contaminants or deficits in dissolved oxygen or essential nutrients. It is possible that erratic or seasonally interrupted flow conditions may not allow sufficient vegetation to support primary herbivores, but this possibility requires confirmation.

Clear Lake and its tributary streams are beneficially used by warm freshwater fish. Species that usually dominate warm water lakes include largemouth and smallmouth bass, bluegill, sunfish, crappie, catfish, and bullhead. The extent to which Scotts Creek is utilized by these fish was not determined in this study. Five of the parameters investigated for Scotts Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

Warm water game species in general have less demanding oxygen requirements than trout. Concentrations of 80 to 100 percent saturation are required during the spring and summer spawning season for eggs and fry. Fingerlings and adults can exist at concentrations above 50 percent of saturation, provided the content does not drop below 5 milligrams per liter (17). Dissolved oxygen concentration objectives for waters that

are especially suitable for fish spawning (including Scotts Creek) have been set at a minimum of 7.0 milligrams per liter at all times. Scotts Creek data measurements suggest no impacts to fish from dissolved oxygen concentrations, with a March high flow value of 10.5 milligrams per liter (100 percent saturation).

Temperature objectives for the Sacramento River Basin are specified in the *Water Quality Control Plan Report* and generally relate to temperature alterations of receiving waters. "At no time or place shall the temperatures of WARM intrastate waters be increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for Scotts Creek have been set, but the Regional Water Quality Board has published guidelines for optimum temperatures for warm water game fish. "Warm water species spawn in the spring and early summer. Bass and sunfish need gradually rising temperatures to 60-70°F (15.6 - 21.1°C). Temperatures should remain in this range during egg incubation. Development of the young is optimum over the range of 70-85°F (21.1 - 29.4°C). Temperatures should not exceed 90°F (32.2°C). Catfish prefer temperatures at the upper portion of these ranges and yellow perch at the lower." The water temperature of Scotts Creek (12.4°C) was taken in March only and is not representative of seasonal variation. However, it does lie below the published guidelines for warm water game fish.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Scotts Creek waters were somewhat turbid at 3.6 Nephelometric Turbidity

Units (NTU) for the high flow period. The Regional Water Quality Board Board has established turbidity objectives for surface waters in the Sacramento River Basin in an effort to minimize fish and wildlife impacts. "Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: Where natural turbidity is between 0 and 50 Jackson Turbidity Units (equivalent to NTU), increases shall not exceed 20 percent." High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold-water species. Observations indicate that fishing success drops off dramatically when turbidity reaches about 25 NTU. Turbidity in Scotts Creek was observed to be well within these ranges.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 6.5 and 8.5 units, as specified by the Sacramento River Basin objectives. In freshwaters with designated WARM beneficial uses, changes in normal ambient pH are limited to 0.5 units within this range. The observed pH for Scotts Creek--6.2 pH units for the high flow period--lies slightly below the range specified under the Basin's objectives.

While no federal or state water quality objectives control dissolved solid concentrations in the Sacramento River Basin, optimum limits have been advised by the Regional Water Quality Control Board. Freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500

milligrams per liter. Dissolved solids in Scotts Creek were observed to be 95 milligrams per liter indicating no problems in this area.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives have been established for the Sacramento River Basin other than requiring that "waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses." Scotts Creek's observed level of nitrate, less than 0.1 milligrams per liter for the high flow period, suggests no nitrate problems.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. The boron concentration in Scotts Creek was observed to be very low: 0.18 milligrams per liter for the high flow period.

Federal objectives for fluoride concentrations in domestic or municipal water supplies have been established and are reproduced within Appendix F. Concentration limits are set for the annual average of maximum daily air temperatures. Because air temperatures were measured only at the time of stream sampling, fluoride data for Scotts Creek cannot be related to federal objectives. However, the fluoride level was observed to be very low: 0.12 milligrams per liter for the high flow period.

REDDING DISTRICT

Four of the investigated streams lie within the jurisdiction of the Redding District Office, and within two California Planning Basins: The Sacramento River Basin - 5A and the Klamath River Basin - 1A.

Sacramento River Basin - 5A

The major waterway of Butte Creek is subject to the mandates and controls of the Central Valley Regional Water Quality Control Board. Details of the Sacramento River Basin have been previously discussed for two Ukiah District streams beginning on page 85 of this report. Data for Butte Creek were compared with water quality objectives set for the Sacramento River Basin which have been reproduced within Appendix G of this report.

- *Butte Creek; Forks, and Power Station*

Butte Creek originates in the mountains of Lassen National Forest in the extreme northern section of Butte County. The stream flows southwesterly past Chico, forms the Butte and Glenn County line, and separates Sutter and Colusa Counties before joining the Sacramento River. Major population centers of Butte County (1970 population of about 102,000) include Oroville and Chico. Nearly every kind of California plant association may be found in the vicinity of Butte Creek waters as they flow from high Sierra Mountain elevations to the lower Central Sacramento Valley. The lower montane forest found between 6,000 feet and lower snow levels is dominated by ponderosa pine with a scattering of incense-cedar, sugar pine, and Douglas fir.

The lower reaches of Butte Creek provide significant anadromous and resident fish migration routes and spawning grounds. Warm-water species include largemouth and smallmouth bass, bluegill, sunfish, and crappie. The upper portions of Butte Creek provide suitable habitat for salmon steelhead, and rainbow and brook trout. Deer are common in the varied habitats of this drainage system, which include coniferous and hardwood forests, chaparral, and grassland. Game birds include blue grouse, wild turkey, mourning dove, band-tailed pigeon, and mountain and California quail.

Recorded beneficial uses of Butte Creek waters from sources to Chico include municipal and domestic supply, agricultural supply, hydroelectric power generation, water-contact recreation, warm and cold freshwater habitat, cold-water fish migration, warm- and cold-water fish spawning, and wildlife habitat (17). No specific water quality objectives for Butte Creek have been set by the Central Valley Regional Water Quality Control Board. For the purposes of this study, Butte Creek data were examined in light of those objectives established for the Sacramento River Basin, which have been reproduced within Appendix G of this report.

This discussion analyzes data collected in September 1977 and in April 1978 from two sites along Butte Creek, both in north-central Butte County. Waters were sampled just upstream of where the West Branch Butte Creek joins the mainstream and at the Power Station near De Sabla, north of the city of Paradise. The results of these studies have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. Eight of the 34 water quality parameters investigated for Butte Creek are subject to

federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna; the ratio of fecal coliform to fecal streptococcus; boron content; and total dissolved solids.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. The Forks of Butte Creek contained 720 total coliform per 100 milliliters for the low flow period and 620 TC per 100 milliliters for the high flow period; the Power Station site revealed 8,200 TC per 100 milliliters and 6,500 TC per 100 milliliters respectively for the low and high flow periods, in significant excess of the federal limits. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before water may be deemed potable.

Sacramento River Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of Butte Creek. "The fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed a geometric mean of 200/100 ml, nor shall more than 10 percent of the total number of samples taken during any 30-day period exceed 400/100 ml." Butte Forks meets

this objective with 60 FC per 100 milliliters for the low flow period and 9 FC per 100 milliliters for the high period. Power Station data shows questionable compliance with the objective, with 360 FC per 100 milliliters for the low flow period and 4 FC per 100 milliliters for the high flow period. However, these data reflect limited sampling and require confirmation with the recommended sampling frequency. The data suggest that Butte Creek waters are safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: respectively 1.00 and 0.15 for the low and high flow measurement periods, suggesting a predominance of livestock or wildlife pollution at Butte Forks; and 2.00 and 0.11 for the low and high flow measurement periods at Butte Power Station, indicating livestock or wildlife pollution.

Benthic fauna for Butte Creek were quantitatively collected at the Forks of the Butte sampling station in the September low flow and the April high flow periods. Six Orders of animals were observed during low flow and seven Orders during the high flow, indicating relatively good water quality throughout the year. The latter animals were numerically dominated by mayflies (Order Ephemeroptera), a sign of healthy primary productivity in Butte Creek waters.

Anadromous fish that currently use reaches of Butte Creek for migration and spawning include the cold-water species of king and silver salmon and rainbow and steelhead trout. Five of the parameters investigated for Butte Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

The eggs of trout and salmon require an abundance of oxygen as well as cool temperatures. Dissolved oxygen concentration objectives for the Butte Creek have been set at 7.0 milligrams per liter at all times. King salmon characteristically spawn in freshwater from September through December; silver salmon from October through March; and steelhead during spring. Dissolved oxygen data at the Forks of the Butte Creek were collected in the September low flow period and the April high flow. These data--10.9 milligrams per liter (100 percent saturation) for both samples--indicate no impacts to fish from dissolved oxygen concentrations. Butte Power Station waters showed dissolved oxygen concentrations in September of 9.4 milligrams per liter (100 percent saturation) and in April of 12.9 milligrams per liter (100 percent saturation), thereby indicating no impacts to fish populations.

Temperature objectives for the Sacramento River Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature alterations of receiving waters. "At no time or place shall the temperatures of any WARM or COLD water be increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for Butte Creek have been set, but the Regional Water Quality Board has published guidelines for optimum salmon and trout temperatures. During salmon spawning the temperatures should be in the 4.5 to 13.5°C range; for egg incubation the desirable range is 5.5 to 13.5°C; and for young development, 10 to 15.5°C. Desirable temperatures for trout spawning are 2.8 to 7.8°C; temperatures for egg incubation should be 5.6 to 12.2°C; and should be from 12.8 to 15.6°C during other periods in the trout life cycle, with an acceptable limit of up to 21.1°C.

Water temperatures for Butte Creek were taken in September and April and do not represent the full range of seasonal variations. Low flow temperatures were 12.1°C for Butte Forks and 20.2°C at the Power Station; high flow temperatures were 9.2°C and 7.6°C for the Forks and Power Station, respectively. No significant temperature problems are apparent from these data.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Butte Forks waters were within these limits at 0.64 Nephelometric Turbidity Units (NTU) for the low flow and 1.3 NTU for the high flow period. Butte Power Station waters were also relatively clear at the low and high flow periods with values of 0.22 and 1.9 NTU, respectively. The Regional Water Quality Control Board has established turbidity objectives for surface waters in the North Coastal Basin in an effort to minimize fish and wildlife impacts. "Increases in turbidity attributable to controllable water quality factors shall not exceed following limits: where natural turbidity is between 0 and 50 Jackson Turbidity Units (equivalent to NTU), increases shall not exceed 20 percent." High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold water species. Observations indicate that fishing success for trout and salmon drops off dramatically

when turbidity reaches about 25 NTU. Turbidity in Butte Creek was observed to be well within these ranges.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 6.5 and 8.5 units, as specified by the Sacramento River Basin objectives. For Butte Creek, changes in normal ambient pH are limited to 0.5 units within this range. Values for Butte Forks--6.6 and 6.3 pH units for the low and high flow periods, respectively--are closely compatible with the Basin's objectives. Measurements at the Power Station--6.4 and 6.2 pH units for the low and high flow periods, respectively--indicate similar compatibility.

While no federal or state water quality objectives control dissolved solids concentrations in the Sacramento River Basin, optimum limits have been advised by the Regional Water Quality Control Board. Freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter. Dissolved solids at Butte Forks were observed to be 66 milligrams per liter for the low flow period and 37 milligrams per liter for the high flow period, indicating no problems in this area. Dissolved solids at the Power Station also fell within the acceptable range at 92 milligrams per liter and 25 milligrams per liter for the low and high flow periods, respectively.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives have been established for the Sacramento River Basin other than requiring that "waters shall not contain biostimulatory substances in

concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses." Butte Fork's observed levels of nitrate, less than 0.1 milligrams per liter for both low and high flow periods, suggests no nitrate problems. Power Station data likewise show very low nitrate concentrations: 0.41 milligrams per liter and less than 0.1 milligrams per liter for the respective low and high flows sampling dates.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. Boron concentrations at Butte Forks were observed to be very low, with a low flow value of less than 0.01 milligrams per liter and 0.09 milligrams per liter for the high flow. Boron concentrations at Butte Power Station were also very low--0.24 milligrams per liter and 0.06 milligrams per liter for the respective low and high flow periods, respectively.

Federal objectives for fluoride concentrations in domestic or municipal water supplies have been established and are reproduced within Appendix F Concentration limits are set for the annual average of maximum daily air temperatures. Because air temperatures were measured only at the time of stream sampling, fluoride data for Butte Creek cannot be related to federal objectives. However, fluoride levels were observed to be very low at both the Forks and Power Station: 0.11 milligrams per liter and less than 0.1 milligrams per liter for the low and high flow periods, respectively.

Klamath River Basin - 1A

The northernmost planning basin in California contains three of the investigated streams: Brock Gulch, Indian Creek, and Willow Creek. The Klamath River Basin, as defined by the California Water Resources Control Board, covers an area of about 10,900 square miles, including all of Del Norte County and portions of Siskiyou, Modoc, Trinity, and Humboldt Counties. Much of the basin is located in some of the most remote regions of California.

With a present total population of only about 52,000, the Klamath River Basin is among the least densely populated areas of the state. The largest concentrations of population are in and near the cities of Crescent City, Yreka, and Weed. Over half of the basin's residents live in communities with populations less than 500 persons. Very modest population growth is seen for the remainder of this century. The projected 2000 population is approximately 60,000, which represents only a 15 percent increase over the present level. Since 1960 the basin has experienced a population decrease of almost 7 percent (13).

The climate of the inland portion of the basin is characterized by warm, dry summers and moderate, wet winters. Annual precipitation varies from 15 to 25 inches, falling mostly during the period from October through March. The region's temperatures vary from the 100+°F in summer to below 0°F in the winter. Average temperatures in July are around 90°F and in January around 20°F.

The climate in the mountain region is characterized by warm summers and mild winters at the higher elevations. Most of the precipitation occurs from November through March, with occasional showers during the remainder of the year. Snow is the primary form of precipitation at the higher elevations (the average snow line is about 4,000 feet). The average annual precipitation varies from 35 inches along the Lower Trinity River to over 100 inches in western Siskiyou County.

The coastal climate is greatly influenced by the ocean and topography, with moderate temperatures and heavy fog commonly occurring. Temperatures remain about 60°F in the summer and seldom drop to freezing during the winter. Precipitation in this region is primarily rain ranging from 60 inches to 125 inches on the average per year.

The mountainous terrain and heavy rainfall in the basin have resulted in the formation of a complex stream system. The total mean annual natural runoff for the entire area is about 16,000,000 acre-feet or an average of about 2.3 acre-feet of runoff per acre. Thus, the basin contains an abundant supply of excellent quality water and is one of the most important areas for fish and wildlife in California (13).

The Klamath River Basin provides a major portion of the State's spawning habitat for anadromous fish and also supports substantial populations of resident fish. The Klamath, Trinity, and Smith Rivers are renowned for salmon and steelhead fishing and support an important portion of the ocean sport and commercial fisheries for these species. Other anadromous fishes that enter the Klamath River are Pacific lamprey, green sturgeon,

American shad, candlefish, and occasionally striped bass, pink salmon, and chum salmon. Many alpine lakes and the upper reaches of many tributaries support rainbow, brown, and brook trout.

Endangered species such as the southern bald eagle and peregrine falcon and rare species such as wolverine, Siskiyou mountain salamander, shortnose sucker, and Lost River sucker occur in the Klamath River Basin.

Water quality within Basin 1-A is generally satisfactory for all of the beneficial uses of water occurring at this time. However, excessive turbidity and sedimentation during the winter and spring have been fairly common problems, degrading fish habitat and discouraging full recreational use and aesthetic enjoyment within the area.

Water quality objectives for inland surface waters of the Klamath River Basin have been established by the California Regional Water Quality Control Board, North Coast Region, and have been approved by the State Water Resources Control Board and the Environmental Protection Agency. The objectives and relevant planning information were published in 1975 under the title *Water Quality Control Plan, Klamath River Basin-1A*, much of which forms the basis for this discussion. Surface water quality objectives for Basin 1A are reproduced in Appendix G.

The Trinity River, a major tributary of the Klamath River, lies in the southern provinces of the Klamath Mountains. It drains a total area of 2,972 square miles and produces an average annual runoff of about 4,250,000 acre-feet. The Trinity River hydrographic unit is predominantly

mountainous, varying in elevation from 305 feet at Weitchpec to 9,025 feet at Mr. Eddy in the northeast corner of the unit. Almost 60 percent of the area has been classified as commercial timberland by the U.S. Forest Service (13).

The most important fishes in the Trinity River are spring and fall run king salmon, silver salmon, and winter and summer run steelhead. King salmon spawn in the main river and in the larger tributaries. Silver salmon and steelhead spawn in the main river and in most of the tributaries. The river supports a small population of brown trout which is believed to be anadromous. American shad, green sturgeon, and Pacific lamprey also occur in the river.

Lower Trinity River

The Lower Trinity River subunit, which contains Brock Gulch, is located along the Trinity River from Douglas City downstream to its confluence with the Klamath River At Weitchpec. The mean annual flow of the Lower Trinity near Burnt Ranch is estimated at 1,150,000 acre-feet. Current beneficial uses of Lower Trinity waters include municipal and domestic water supply, agricultural supply, groundwater recharge, freshwater replenishment, contact and non-contact water recreation, cold freshwater habitat, wildlife habitat, anadromous fish migration, and fish spawning. Potential uses of these waters include industrial service and process supply. Water quality data for this reach indicate that Trinity River waters are generally excellent and suitable for all established and potential beneficial uses (13).

In addition to the water quality objectives adopted for the Klamath River Basin, the Regional Water Quality Control Board has set specific objectives for the Lower Trinity River and for "other streams" within the Lower Trinity hydrographic subunit. Brock Gulch is subject to these regulations, which include:

Parameter	*Min.*	*90% Values*	*Median*[1]	*Max.*
Specific Conductance (micromhos @ 77°F)	-	250	200	-
Dissolved Oxygen (mg/l)	9.0	-	10.0	-
Hydrogen Ion (pH)	7.0	-	-	8.5
Hardness (mg/l)	-	-	100	-
Boron (mg/l)	-	0.1	0.0	-

[1]*Median values represent the 50 percentile values of the monthly means for a calendar year.*

SOURCE: *California Regional Water Quality Control Board, North Coast Region*

- *Brock Gulch*

Brock Gulch joins the Trinity River near Helena in Trinity County. Data collected under the present study offer a guide to the general water quality of Brock Gulch and have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. The recorded values for 33 biological, chemical, and physical parameters were compared with current federal

standards for community drinking water, and state/basin/stream-specific surface water quality objectives. Eleven of the 33 water quality parameters investigated for Brock Gulch are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, conductivity, hardness, boron, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and total dissolved solids.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. Brock Gulch samples contained 2,140 total coliform per 100 milliliters for the low flow and 3,000 TC per 100 milliliters for the high flow period, in significant excess of the federal limits. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

Klamath River Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of the Trinity River and adjacent streams. "The median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 milliliters, nor shall more than 10 percent of

total samples during any 30 day period exceed 400 per 100 milliliters." Brock Gulch marginally exceeds this objective with 80 FC per 100 milliliters for the low flow period and 0 FC per 100 milliliters for the high flow period. However, these data reflect limited sampling and require confirmation with the recommended sampling frequency. The data suggest that Brock Gulch waters are safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 0.36, suggesting a predominance of livestock pollution.

At Brock Gulch, no animals were collected or observed during the August visit when the Creek discharge was zero. The high flow sampling visit, however, revealed 11 different taxonomic groups with over 350 individuals per square foot. Mayflies (Order Ephemeroptera) dominated the group, with snails (Order Mesogastropoda) comprising the second most numerous group. The presence of both mayflies and snails indicate the likelihood of plentiful periphyton, algae, and organic debris. No grazing or logging-associated problems were evident in the vicinity of the site.

Anadromous fish that have historically used or currently use reaches of the Trinity River System for migration and spawning include the cold-water species of king and silver salmon, and steelhead trout. The extent to which Brock Gulch is utilized by these fish was not determined in this study. Five of the parameters investigated for Brock Gulch relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

The eggs of trout and salmon require an abundance of oxygen as well as cool temperatures. Dissolved oxygen concentration objectives for "other streams" in the Lower Trinity River region have been set at a minimum of 9.0 milligrams per liter with a median value of 10.0 milligrams per liter. King salmon characteristically spawn in freshwater from September through December; silver salmon from October through March; and steelhead during spring (13). Brock Gulch data were collected in the late August low flow period and the April high flow period. These data indicate no impacts to fish from dissolved oxygen concentrations with values of 10.2 milligrams per liter (100 percent saturation) and 10.5 milligrams per liter (95 percent saturation), respectively. However, the August flow for Brock Gulch was observed to be so low as to preclude its use for spawning or migration.

Temperature objectives for the Klamath River Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature alterations of receiving waters. "At no time or place shall the temperature alterations of any COLD water [habitat] be increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for the Lower Trinity River have been set, but the Regional Water Quality Board has published guidelines for optimum salmon and trout temperatures. During salmon spawning the temperatures should be in the 4.5 to 13.5°C range; for egg incubation the desirable range is 5.5 to 13.5°C; and for young development, 10 to 15.5°C. Desirable temperatures for trout spawning are 2.8 to 7.8°C; temperatures for egg incubation should be 5.6 to 12.2°C; and should be from 12.8 to 15.6°C during other periods in the trout life cycle, with an acceptable

limit of up to 21.1°C (13). Water temperatures for Brock Gulch (15.2°C-low, 9.1°C-high) were taken in late August and April and are not representative of seasonal variations. However, no significant temperature problems are apparent from these data.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Brock Gulch waters were within these limits at 0.80 Nephelometric Turbidity Units (NTU) for the low flow and 0.50 NTU for the high flow periods. The Regional Water Quality Control Board has established turbidity objectives for surface waters in the Klamath River Basin in an effort to minimize fish and wildlife impacts. "Turbidity shall not be increased more than 20 percent above naturally occurring background levels." High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold water species. Observations indicate that fishing success for trout and salmon drops off dramatically when turbidity reaches about 25 NTU (13). Turbidity in Brock Gulch was observed to be well within these ranges.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 7.0 and 8.5 units, as specified by the water quality objectives for the Lower Trinity River and other streams within its basin. For the Lower

Trinity River, changes in normal ambient pH are limited to 0.5 units within this range. Values for Brock Gulch were 7.6 and 6.2 pH units for the low and high flow periods, respectively, indicating incompatibility with the Basin's objectives during periods of high flow.

Dissolved solids in Brock Gulch were observed to be 164 milligrams per liter (low flow) and 113 milligrams per liter (high flow). While no federal, state, or river-specific objectives exist for the Lower Trinity Basin, it is known that freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter. Brock Gulch values were well within the acceptable range.

Conductivity standards for "other streams" in the Lower Trinity Basin, including Brock Gulch, have been set at 250 micromhos (90 percent values) and 200 micromhos (median). Observed values for Brock Gulch are 230 micromhos (low flow) and 130 micromhos (high flow), indicating acceptable levels of ionized substances.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives for nitrate have been specifically established for the Lower Trinity River. Brock Gulch's observed levels of nitrate nitrogen, 0.12 milligrams per liter and less than 0.1 milligrams per liter for the respective low and high flow periods, suggest no problems in this area.

Water hardness, measured as milligrams per liter of $CaCO_3$, was studied for Brock Gulch waters and compared with established objectives. The

median values of hardness should be 100 milligrams per liter, as recommended for streams in the Lower Trinity River subunit. Recorded values were 141 milligrams per liter for the low flow and 90.3 milligrams per liter for the high flow period, indicating the presence of moderately hard waters.

Specific objectives for boron concentrations have been set by the Regional Water Quality Control Board for the Lower Trinity River and other streams within the drainage basin. Ninety percent of the values for boron content of Lower Trinity River waters should be 0.2 milligrams per liter or less and less than 0.1 milligrams per liter for other streams. Median values in both cases should be 0.0 milligrams per liter. Boron concentrations for Brock Gulch were observed to be 0.27 and 0.06 milligrams per liter for the low and high flow periods, respectively. Further monitoring during periods of low flow would be required to determine the extent to which higher boron concentrations fall outside the 90 percent median value objective.

Klamath River Basin objectives for fluoride concentrations in domestic or municipal water supplies have been established and are reproduced within Appendix G. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling, fluoride data for Brock Gulch cannot be related to Basin objectives. However, fluoride levels were observed to be very low: 0.15 milligrams per liter and less than 0.1 milligrams per liter for the low and high flow periods, respectively.

Scott River

Another major tributary of the Klamath River is the Scott River, which traverses the western half of Siskiyou County and receives waters from one of the subject streams: Indian Creek. Scott Valley, which has a north-south length of about 20 miles, is narrow at its southern section near Callahan, and widens to about 7 miles near Greenview. The area of the valley is approximately 100 square miles and varies in elevation from about 2,500 feet to 3,000 feet. Southeast of the valley are the Scott Mountains; to the west and south are the Salmon Mountains, and to the north and northwest are the Scott Bar and Marble Mountains.

The Scott Valley subunit is drained by the Scott River which flows in a northerly direction to the Klamath River. Drainage extends into the summer, beyond the main precipitation period, and is sustained by the melting snowpack of the Shasta Eddys, the Scott Mountains, and the Salmon Mountains. The average annual flow of the Scott River measured near Fort Jones is 482,000 acre-feet per year (13).

Most streams of the subunit, including the Scott River, are productive waters which support good resident trout and seasonal salmon fisheries. Fall run king salmon, silver salmon, and winter run steelhead spawn in the Scott and its tributaries. Many alpine lakes in the drainage are stocked with rainbow trout and brook trout. Deer, bear, and mountain lion occur in the Scott River drainage. Mountain quail, California quail, Sierra grouse, ruffed grouse, and band-tailed pigeon are the principal upland game species. Furbearers include river otter, mink, and beaver.

Current beneficial uses of Scott River waters include agricultural supply, groundwater recharge, freshwater replenishment, contact and non-contact water recreation, cold freshwater habitat, wildlife habitat, anadromous fish migration, and fish spawning. Potential uses of these waters include municipal and domestic water supply, and industrial service and process supply.

In addition to the water quality objectives adopted for the Klamath River Basin, the Regional Water Quality Control Board has established specific objectives for the Scott River and for "other streams" within the Scott Valley hydrographic subunit. Indian Creek is subject to these regulations, which include:

Parameter	*Min.*	*90% Values*	*Median*[1]	*Max.*
Specific Conductance (micromhos @ 77°F)	-	400	275	-
Dissolved Oxygen (mg/l)	7.0	-	9.0	-
Hydrogen Ion (pH)	7.0	-	-	8.5
Hardness (mg/l)	-	-	120	-
Boron (mg/l)	-	0.2	0.1	-

[1]*Median values represent the 50 percentile values of the monthly means for a calendar year.*

SOURCE: *California Regional Water Quality Control Board, North Coast Region*

• *Indian Creek*

Indian Creek joins the Scott River near Fort Jones in west-central Siskiyou County. Data were collected only once in August 1977 and offer a guide to the general water quality of Indian Creek. These data have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. Eleven of the 32 water quality parameters investigated for Indian Creek are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, conductivity, hardness, boron, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and total dissolved solids.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. Indian Creek samples contained 6,100 TC per 100 milliliters for the low flow, in significant excess of the federal limits. However, this is not unexpected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

Klamath River Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of the Scott

River and adjacent streams. "The median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 ml, nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 ml." Although the 60 FC per 100 milliliters measured in Indian Creek for the low flow period marginally exceeded the 50/100 milliliter objectives, the data value reflects limited sampling and requires confirmation with the recommended sampling frequency. The data value suggests that Indian Creek waters are safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 0.15, suggesting a predominance of livestock or wildlife pollution.

Benthic fauna in Indian Creek waters could not be quantitatively identified due to the extremely low flow at the time of sampling. Two Orders were observed, however, in the benthic zone: Trichoptera (caddisflies) and Mesogastropoda (snails). The presence of snails indicates the likelihood of year-round flow and plentiful periphyton, algae, and organic debris.

Anadromous fish that have historically used or currently use reaches of the Scott River System for migration and spawning include the cold-water species of king and silver salmon, and steelhead trout. The extent to which Indian Creek is utilized by these fish was not determined in this study. Five of the parameters investigated for Indian Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

The eggs of trout and salmon require an abundance of oxygen as well as cool temperatures. Dissolved oxygen concentration objectives for "other streams" in the Scott Valley subunit have been set at a minimum of 7.0 milligrams per liter with a median value of 9.0 milligrams per liter. King salmon characteristically spawn in freshwater from September through December; silver salmon from October through March; and steelhead during spring (13). Indian Creek data were collected in the August low flow period only. A dissolved oxygen concentration of 8.5 milligrams per liter (100 percent saturation) was measured and suggests that no impact on fish occurs in that regard. However, the August flow was observed to be so low as to preclude its use for fish spawning and migration.

Temperature objectives for the Klamath River Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature alterations of receiving waters. "At no time or place shall the temperatures of any COLD water [habitat] be increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for the Scott River or adjacent streams have been set, but the Regional Water Quality Board has published guidelines for optimum salmon and trout temperatures. During salmon spawning the temperatures should be in the 4.5 to 13.5°C range; for egg incubation the desirable range is 5.5 to 13.5°C; and for young development, 10 to 15.5°C. Desirable temperatures for trout spawning are 2.8 to 7.8°C; temperatures for egg incubation should be 5.6 to 12.2°C; and should be from 12.8 to 15.6°C during other periods in the trout life cycle, with an acceptable limit of up to 21.1°C. The water temperature for Indian Creek (19.8°C-low flow period) was taken in late August and is not representative of

seasonal variation. However, no significant temperature problems are apparent from this data value.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Indian Creek waters were well within these limits at 0.34 Nephelometric Turbidity Units (NTU) for the low flow period. The Regional Water Quality Control Board has established turbidity objectives for surface waters in the Klamath River Basin in an effort to minimize fish and wildlife impacts. "Turbidity shall not be increased more than 20 percent above naturally occurring background levels." High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold water species. Observations indicate that fishing success for trout and salmon drops off dramatically when turbidity reaches about 25 NTU. Turbidity in Indian Creek was observed to be well within these ranges.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 7.0 and 8.5 units, as specified by the water quality objectives for the Scott River and other streams within its basin. For the Scott River changes in normal ambient pH are limited to 0.5 units within this range. The measured pH value for Indian Creek--6.9 pH units for the low flow period--falls just below the water quality objective.

Dissolved solids in Indian Creek were observed to be 183 milligrams per liter (low flow). While no federal, state, or river-specific objectives exist for dissolved solids in the Klamath River Basin, freshwater fish are known to thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter. The Indian Creek value was well within the acceptable range. No federal drinking water standards are extant for the dissolved solids.

Conductivity standards for "other streams" in the Scott River Basin have been set at 400 micromhos (90% values) and 275 micromhos (median). The observed value for Indian Creek is 270 micromhos (low flow), indicating an acceptable level of ionized substances.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives for nitrate have been specifically established for the Klamath River Basin or the Scott River. Indian Creek's observed level of nitrate nitrogen, 0.15 milligrams per liter for the low flow period, suggests no problems in this area.

Water hardness, measured as milligrams per liter of $CaCO_3$, was studied for Indian Creek waters and compared with established objectives. The median values of hardness should be 120 milligrams per liter, as recommended for streams in the Scott Valley subunit. The recorded value for Indian Creek was 157 milligrams per liter for the low flow period, indicating hard waters at the time of sampling.

Specific objectives for boron concentrations have been set by the Regional Water Quality Control Board for the Scott River and other streams within the drainage basin. Ninety percent of the values for boron content of Scott River waters should be 0.4 milligrams per liter or less and 0.2 milligrams per liter or less for other streams, including Indian Creek. Median values in both cases should be 0.1 milligrams per liter. The measured boron concentration for Indian Creek was determined to be 0.33 milligrams per liter for the low flow period and is in excess of the recommended 90 percent maximum value.

Klamath River Basin objectives for fluoride concentrations in domestic or municipal water supplies have been established and are reproduced within Appendix G. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling, fluoride data for Indian Creek cannot be related to Basin objectives. However, the fluoride level was observed to be very low: 0.15 milligrams per liter for the low flow period.

Shasta River

The Shasta River Basin contains one of the streams under investigation: a tributary of Willow Creek. Shasta Valley, which has a north-south length of about 30 miles and a maximum width of 15 miles, has an area of about 220 square miles. The valley varies in elevation from 2,500 feet above sea level near Montague to about 3,000 feet near Edgewood. It is situated along the eastern slopes of the Klamath Mountains and includes a portion of the western slopes of the Cascade Range. The Cascade Range

consists of a north-south trending chain of dormant or extinct volcanoes. Mt. Shasta, the highest volcanic cone in the chain, rises almost 2 miles above its base to 14,162 feet above sea level at the southeast end of Shasta Valley.

The principal stream of the subunit is Shasta River. The river flows from south to north from its origin near Weed, through Lake Shastina to the Klamath River, a distance of approximately 42 miles. The average annual flow of the Shasta River measured near Yreka is 136,000 acre-feet per year.

Fall run king salmon, silver salmon, and winter run steelhead spawn in the Shasta River. Dwinnell Dam prevents anadromous fish from spawning more than 37 miles upstream. Both Columbian black-tailed deer and Rocky Mountain mule deer are common in the Shasta River drainage. Other big game species are black bear and mountain lion. Other important game species include valley quail, mountain quail, band-tailed pigeon, mourning dove, cottontail rabbit, muskrat, mink, and beaver. The many farmponds in Shasta Valley provide resting and nesting areas for migratory waterfowl and other birds.

Data from the upper reaches of the Shasta River, including Lake Shastina, indicate that water is generally of excellent mineral quality. The Shasta River below Shastina Reservoir provides satisfactory quality water for king salmon and steelhead spawning and nursery areas.

Current beneficial uses of Shasta River waters include agricultural supply, groundwater recharge, freshwater replenishment, contact and non-contact water recreation, warm and cold freshwater habitat, wildlife habitat, anadromous fish migration, and spawning. Potential beneficial uses include municipal and domestic water supply, industrial service and process supply, and hydropower generation.

In addition to the water quality objectives adopted for the Klamath River Basin, the Regional Water Quality Control Board has established specific objectives for the Shasta River and "other streams" within the Shasta hydrographic subunit. Willow Creek waters are subject to these regulations, which include:

Parameter	*Min.*	*90% Values*	*Median*[1]	*Max.*
Specific Conductance (micromhos @ 77°F)	-	700	400	-
Dissolved Oxygen (mg/l)	7.0	-	9.0	-
Hydrogen Ion (pH)	7.0	-	-	8.5
Hardness (mg/l)	-	-	200	-
Boron (mg/l)	-	0.5	0.1	-

[1]*Median values represent the 50 percentile values of the monthly means for a calendar year.*

SOURCE: *California Regional Water Quality Control Board, North Coast Region*

- *Willow Creek Tributary*

Willow Creek joins the Shasta River near Yreka in Siskiyou County. Data collected under the present study offer a guide to the general water quality of a tributary of Willow Creek, and have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. Eleven of the 34 water quality parameters investigated for the Willow Creek Tributary are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, conductivity, hardness, boron, nitrate nitrogen, fluoride, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and total dissolved solids.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. The Willow Creek Tributary samples contained 60 total coliform per 100 milliliters for the low flow and 1,080 TC per 100 milliliters for the high flow period; both are in excess of the federal limits. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

Klamath River Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of the Shasta River and adjacent streams. "The median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 ml, nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 ml." Measured values for the Willow Creek Tributary were 60 FC per 100 milliliters for the low flow period and 2 FC per 100 milliliters for the high flow period. Although the former value is slightly in excess of the 50/100 ml criteria, the data reflect limited sampling and require confirmation with the recommended sampling frequency. The data suggest that Willow Creek Tributary waters are safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 3.0, suggesting a predominance of livestock pollution.

Benthic fauna at the Willow Creek Tributary were quantitatively assessed in the April high flow period. A numerical majority of collected specimens were mayflies (Order Ephemeroptera) and stoneflies (Order Plecoptera), indicating relatively healthy primary productivity and good water quality for the Willow Tributary (14).

Anadromous fish that have historically used or currently use reaches of the Shasta River System for migration and spawning include the cold-water species of king and silver salmon and steelhead trout. The extent to which Willow Creek is utilized by these fish was not determined in this study. Five of the parameters investigated for Willow Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

The eggs of trout and salmon require an abundance of oxygen as well as cool temperatures. Dissolved oxygen concentration objectives for the Shasta River and adjacent streams have been set at a minimum of 7.0 milligrams per liter with a median value of 9.0 milligrams per liter. King salmon characteristically spawn in freshwater from September through December; silver salmon from October through March; and steelhead during spring. Willow Creek Tributary data were collected in the September low flow period and the April high flow. These data--7.4 milligrams per liter (80 percent saturation) and 11.5 milligrams per liter (100 percent saturation), respectively--indicate no impacts to fish from dissolved oxygen concentrations. However, the September flow was observed to be so low as to preclude its use for fish spawning or migration.

Temperature objectives for the Klamath River Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature alterations of receiving waters. "At no time or place shall the temperatures of any COLD water [habitat] be increased by more than 5°F (2.8°C) above natural receiving water temperature." No specific temperature objectives for the Shasta River have been set, but the Regional Water Quality Board has published guidelines for optimum salmon and trout temperatures. During salmon spawning the temperatures should be in the 4.5 to 13.5°C range; for egg incubation the desirable range is 5.5 to 13.5°C; and for young development, 10 to 15.5°C. Desirable temperatures for trout spawning are 2.8 to 7.8°C; temperatures for egg incubation should be 5.6 to 12.2°C; and should be from 12.8 to 15.6°C during other periods in the trout life cycle, with an acceptable limit of up to

21.1°C. Water temperatures for the Willow Creek Tributary were taken in September (12.8°C) and April (5.7°C) and are not representative of seasonal variations. However, no significant temperature problems are apparent from these data.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Willow Creek Tributary waters were within these limits at 0.60 Nephelometric Turbidity Units (NTU) for the low flow, but exceeded the objective in April with a high flow value of 7.0 NTU. The Regional Water Quality Control Board has established turbidity objectives for surface waters in the Klamath River Basin in an effort to minimize fish and wildlife impacts. "Turbidity shall not be increased more than 20 percent above naturally occurring background levels." High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold water species. Observations indicate that fishing success for trout and salmon drops off dramatically when turbidity reaches about 25 NTU. Turbidity in the Willow Creek Tributary was observed to be well within these ranges.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 7.0

and 8.5 units, as specified by the water quality objectives for the Shasta River and other streams within its basin. For the Shasta River, changes in normal ambient pH are limited to 0.5 units within this range. Values for Willow Creek Tributary were 6.4 and 8.1 pH units for the low and high flow periods, respectively, and indicated nonattainment of the desired objectives during the low flow period only.

Dissolved solids in the Willow Creek Tributary were observed to be 500 milligrams per liter (low flow) and 364 milligrams per liter (high flow). While no federal, state, or river-specific objectives exist for the Shasta River Basin, these values are significantly greater than dissolved solid concentrations for the other investigated streams. However, freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter; Willow Creek Tributary values were within this range.

Conductivity standards for other streams in the Shasta Valley have been set at 700 micromhos (90% values) and 400 micromhos (median). Observed values for the Willow Creek Tributary were 700 micromhos (low flow) and 370 micromhos (high flow), indicating acceptable levels of ionized substances.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. No surface water objectives for nitrate have been specifically established for the Shasta River Basin. Willow Creek Tributary's observed levels of nitrate, 0.27 milligrams per liter and 0.28 milligrams per liter for the respective low and high flow sampling periods, suggest no problems in this area.

Water hardness, measured as milligrams per liter of $CaCO_3$, was studied for Willow Creek Tributary waters and compared with established objectives. The median values of hardness should be 200 milligrams per liter, as recommended for streams in the Shasta River subunit. Recorded values were 507 milligrams per liter for the low flow and 349 milligrams per liter for the high flow period, indicating very hard waters.

Specific objectives for boron concentrations have been set by the Regional Water Quality Control Board for the Shasta River and other streams within the drainage basin. Ninety percent of the values for boron content of Shasta River waters should be 1.0 milligrams per liter and 0.1 milligrams per liter for other streams. Boron concentrations for the Willow Creek Tributary were observed to be 0.37 and 0.06 milligrams per liter for the low and high flow periods, respectively; the former is in excess of the recommended 90 percent maximum value.

Klamath River Basin objectives for fluoride concentrations in domestic or municipal supply have been established and are reproduced within Appendix G. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling, fluoride data for the Willow Creek Tributary cannot be related to Basin objectives. However, fluoride levels were observed to be very low: 0.12 milligrams per liter and less than 0.1 milligrams per liter for the low and high flow sampling periods, respectively.

Susanville District

Water quality aspects for six of the investigated streams are discussed below in relation to their environmental settings within the North Lahontan Basin (6A) of California and the State of Nevada.

North Lahontan Basin - 6A

Another investigated stream lies within the North Lahontan Basin: Bare Creek. The states of Oregon and Nevada form the northern and eastern boundaries of this Basin which is approximately 270 miles long (north-south) and from 5 to 65 miles wide (east-west). Major mountain ranges in the Basin include the Sierra Nevada, the Warner Mountains, and the Diamond Mountains. Other notable topographic features include Surprise Valley, Honey Lake Valley, Bridgeport Valley, and the Madeline Plains.

Generally, climatic conditions vary widely throughout the Basin, from the hot, semiarid areas in Modoc and Lassen Counties near the Nevada border to the cool, water-rich Sierra Nevada on the western border of the Basin. Because hydrographic features in the northern half of the Basin are generally characterized by closed basins, all precipitation falling into that part of the Basin either is consumed by evapotranspiration and by evaporation from surface storage sites or is stored in surface sites and groundwater basins. In the southern half of the Basin, most precipitation is generally lost through local uses, evaporation, or runoff into Nevada. However, some of the precipitation is stored in groundwater basins or in surface storage sites.

More than 75 percent of all precipitation occurs during the period from October through April, with little precipitation during the summer except for occasional thunderstorms. Precipitation ranges from 4 inches per year in the Surprise Valley to 70 inches per year in the Sierra Nevada. Temperatures have been as low as -37°F in the Walker River areas and over 100°F in Surprise Valley (19).

The most important lakes and reservoirs in the Basin include the three Alkali Lakes; Eagle Lake; Honey Lake; Lake Tahoe; Topaz Lake; and Stampede, Boca, Martis Valley, and Bridgeport Reservoirs. Rivers of significance include the Susan, Truckee, Carson, and Walker Rivers. Major tributaries to the Alkali Lakes are Bidwell Creek in the northwest; North and South Deep Creeks west of Middle Alkali Lake; Bare Creek in the southwest; and Rock Creek, Sand Creek, and Forty-nine Creek.

Water quality in the northern half of the Basin varies from excellent to poor, depending on location and geologic conditions. Because most of the hydrographic units in this part of the North Lahontan Basin are closed basins, salts tend to accumulate in the lowest areas of each basin. In addition, this portion of the Basin is tectonically active and contains thermal springs which usually have high concentrations of sodium, chloride, sulfate, arsenic, boron, and fluoride. Chemical analyses from wells indicate that these springs often degrade the quality of adjacent groundwaters and surface streams (19). Water quality objectives for inland surface waters of the North Lahontan Basin have been established by the California Regional Water Quality Control Board, North Coast Reigon, and approved by the State Water Resources Control Board and the Environmental

Protection Agency. The objectives and relevant planning information were published under the title *Water Quality Control Plan, North Lahontan Basin - 6A*, much of which forms the basis for this discussion. Surface water quality objectives are reproduced in Appendix G.

Surprise Valley

The Surprise Valley, containing Bare Creek, is located in the northeastern corner of California, bounded by the Oregon and Nevada borders about 150 miles northwest of Reno, Nevada. Approximately 85 percent of the Surprise Valley is within Modoc County, and the remainder is in northeast Lassen County. The most prominent features of the Surprise Valley are the three Alkali Lakes--Upper Alkali Lake, Middle Alkali Lake, and Lower Alkali Lake--which have maximum water surface areas of about 28,000, 17,000, and 10,000 acres, respectively. These lakes occupy almost one-fourth of the valley area, are very shallow, and are frequently dry, depending on the amount of runoff the lakes receive in a particular year (19).

Most streams draining into Surprise Valley rise along the eastern slopes of the Warner Mountains and discharge into the Upper, Middle, or Lower Alkali Lakes. There is a striking contrast between the mineral quality of these streams and that of the Alkali Lakes. Water in the streams is a calcium bicarbonate type with low mineral content, while the Alkali Lakes' waters have a sodium chloride type mineral content with high concentrations of boron and fluoride; consequently, these lake waters are unsatisfactory for most beneficial uses. The poor quality of the Alkali Lakes may be attributed in part to inflow of waters from adjacent, highly mineralized hot springs and to evaporation which concentrates salts within the lakes (19).

The vegetation of the Surprise Valley reflects the climate and topography. Most of the valley is covered by northern desert shrub, although there are extensive cultivated and pastured areas. Coniferous forests predominate in the Warner Mountains.

- *Bare Creek*

Bare Creek originates in the extreme northeastern section of Lassen County, flows north into the Surprise Valley and Modoc County, and follows a man-made ditch to the Lower Alkali Lake. No significant surface water development has occurred in the Bare Creek vicinity. Current beneficial uses of Bare Creek waters include agricultural supply, groundwater recharge, water-contact and non-water-contact recreation, cold freshwater habitat, and wildlife habitat.

In addition to the water quality objectives adopted for the North Lahontan Basin, the Regional Water Quality Control Board has established specific objectives for Bare Creek. They include:

	Annual Average Value (mg/ℓ)
Total Dissolved Solids	110.
Boron	0.02
Total Nitrogen	0.1

SOURCE: *California Regional Water Quality Control Board, Lahontan Region*

Data collected under the present study offer a guide to the general water quality of Bare Creek, and have been presented in the previous section within

Tables 3, 4, 5A, 5B, and 6. Nine of the 35 water quality parameters investigated for Bare Creek are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, boron, total dissolved solids, total nitrogen, water temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, and the ratio of fecal coliform to fecal streptococcus.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be present also. Bare Creek samples contained 70,000 total coliform per 100 milliliters for the low flow and 1,000 TC per 100 milliliters for the high flow period, in significant excess of the federal limits. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

North Lahontan Basin fecal coliform (FC) objectives have been set for waters designated for contact recreation, including those of Bare Creek. "The fecal coliform concentration based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200/100 ml, nor shall more than 10 percent of total samples during any 30-day period exceed 400/100 mls." Bare Creek waters yielded 500 FC/100 mls for the low flow period, yet was within the limits for the high period with

2 FC/100 ml. However, the data reflect limited sampling and require confirmation with the recommended sampling frequency. The data do suggest that, during periods of low flow, Bare Creek waters may not conform to objectives specified for recreational swimming or other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 3.13, suggesting a predominance of livestock pollution.

Benthic fauna sampled at Bare Creek showed significant numbers of mayflies (Order Ephemeroptera) in both low and high flow periods. The presence of large numbers of mayfly nymphs indicates the correspondingly high photosynthetic productivity necessary to support these primary herbivores. A complex food chain requires such conditions for the support of predators. Other groups observed at Bare Creek include Order Diptera, Order Coleoptera, and Order Oligochaeta.

Bare Creek has been identified as a cold freshwater habitat sustaining aquatic species. Cold-water fish indigenous to the North Lahontan Basin include trout, mountain whitefish, kokanee salmon, and tui chub. The extent to which Bare Creek is utilized by these species was not determined in this study. Five of the parameters investigated for Bare Creek relate directly to fish populations: dissolved oxygen, temperature, turbidity, pH, and dissolved solids.

The eggs of trout require an abundance of oxygen as well as cool temperatures. Dissolved oxygen concentration objectives for Bare Creek have been set at 80 percent saturation or 7.0 milligrams per liter at all times. Bare Creek data were collected in the August low flow period and the April

high flow. Corresponding measured dissolved oxygen concentrations were 10.0 milligrams per liter (100 percent saturation) and 10.5 milligrams per liter (100 percent saturation), respectively, and indicated no impacts to fish.

Temperature objectives for the North Lahontan Basin are specified in the *Water Quality Control Plan* report and generally relate to temperature alterations of receiving waters. "At no time or place shall the temperatures of any warm water be increased by more than $5^{o}F$ ($2.8^{o}C$) above natural receiving water temperature. Temperature of cold water shall not be raised above natural levels". No specific temperature objectives for Bare Creek have been set, but the Regional Water Quality Board has published guidelines for optimum trout temperatures. Desirable temperatures for trout spawning are 2.8 to $7.8^{o}C$; temperatures for egg incubation should be 5.6 to $12.2^{o}C$; and should be from 12.8 to $15.6^{o}C$ during other periods in the trout life cycle, with an acceptable limit of up to 21.1°C. Water temperatures for Bare Creek were taken in late August (20.3°C) and April (7.5°C) and are not representative of seasonal variations. However, no significant temperature problems are apparent from the data.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Bare Creek waters were well within these limits at 0.15 Nephelometric Turbidity Units (NTU) for the low flow but greatly violated this objective during the high flow period with a value at 25 NTU. The Regional Water Quality

Control Board has established turbidity objectives for surface waters in the North Lahontan Basin in an effort to minimize fish and wildlife impacts. "Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity shall not exceed natural levels by more than 10%. High turbidity reduces light penetration and aquatic plant growth, which can have a significant effect on fish, wildlife, and recreational fishing. Turbidity ranges from 0 to 10 NTU are most satisfactory for the development of eggs and fry of all freshwater fishes. Ranges from 0 to 25 NTU are satisfactory for the production of fingerling and adult cold water species. Observations indicate that fishing success for trout and salmon drops off dramatically when turbidity reaches about 25 NTU. Turbidity in Bare Creek was observed to be well within these ranges at the time of low flow sampling; however, high flow values were great enough to potentially interfer with beneficial uses.

Production of fish and other freshwater organisms is generally higher in slightly alkaline waters. The pH should be maintained between 6.5 and 8.5 units, as specified by the North Lahontan Basin objectives. For Bare Creek, changes in normal ambient pH are limited to 0.5 units within this range. Values for Bare Creek indicate slightly alkaline waters: 8.8 and 6.5 pH units for the low and high flow periods, respectively.

Dissolved solids in Bare Creek were observed to be 98 milligrams per liter (low flow) and 80 milligrams per liter (high flow), which are within the objectives of 110 milligrams per liter (annual average value) set for Bare Creek. Freshwater fish thrive at dissolved solid concentrations ranging from 100 to 500 milligrams per liter. The California Department of Water

Resources has monitored the water quality of 21 streams in the Surprise Valley hydrographic unit and has recorded dissolved solid values between 47 and 332 milligrams per liter, with an average of 87 milligrams per liter. No federal drinking water standards are extant for dissolved solids.

The State of California has adopted the federal drinking water standard for nitrate nitrogen of 10 milligrams per liter. Surface water objectives for total nitrogen have been established for Bare Creek: 0.1 milligrams per liter as an annual average value. Bare Creek's observed levels of nitrate, 0.53 milligrams per liter and less than 0.1 milligrams per liter for the respective low and high flow periods, indicate a potential problem with non-compliance with surface water objectives. Additional study as to the source and controllability of Bare Creek's total nitrogen is recommended.

Specific objectives have been established for the boron content of Bare Creek waters: 0.02 milligrams per liter as an annual average value. At the times of stream sampling, boron concentrations were 0.05 milligrams per liter and 0.14 milligrams per liter for the respective low and high flow periods. Bare Creek waters are beneficially used for agricultural supply and therefore sensitive to increased boron concentrations. Waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter.

Nevada Streams

Five of the investigated streams lie within Washoe County in the northwestern segment of Nevada: Badger Creek, High Rock Creek, Lost Creek, Wall Creek,

and Wall Canyon Creek. Northern Washoe County is a relatively barren, arid and sparsely populated region lying generally above the 5000-foot elevation. Four of the five streams are classified as intermittant watercourses with no significant municipal, industrial or agricultural development in the area.

The population of Washoe County was 121,068 in 1975 with nearly 73,000 residing in Reno, the County Seat. The population density in the vicinity of the streams is less than 2 occupants per square mile, compared with a statewide density of more than 4 per square mile. This region receives about 12 inches of precipitation annually in the form of melted snow and other moisture. Temperatures range from January lows of $-9^{o}C$ to July highs of $33^{o}C$.

Vegetation cover in the arid regions of Washoe County include sparse associations of bitter bush, mesquite, rabbit brush, sagebrush, and shadscale. These provide habitat for badgers, coyote, foxes, minks, marmots, muskrats, porcupines, rabbits and raccoons. Partridges, ducks, geese and white pelicans are found in the aquatic environments, such as Anahoe Island Wildlife Refuge in Pyramid Lake. Habitat suitable for pronghorn antelope is preserved in the extreme northern provinces of Washoe and Humboldt Counties, in the Charles Sheldon Antelope Range.

Water quality standards for Nevada surface waters have been established by the State Commission of Environmental Protection for the purposes of 1) protecting the public health and welfare, 2) enhancing the quality of water, 3) increasing the use and value of public water supplies, 4) pro-

moting the propagation of fish and wildlife, and 5) enhancing recreational, agricultural, industrial, navigational, and other beneficial uses. Adopted standards relate to "...the condition of waters as affected by discharges relating to the activities of man."

Article 4 of the Nevada Water Pollution Control Regulations contains a listing and classification of public waters outlining specific water quality standards for certain water systems. Classifications and standards are based primarily upon the recorded beneficial uses of the subject water. Of the five Nevada streams investigated in this study, none are specifically listed or classified by the State Commission of Environmental Protection. As stated in the regulations, "the Commission will consider classification of a public water not contained in these tables (Article 4) upon request for a permit to discharge to such waters." Specific water quality standards are established only for those Nevada waters receiving waste discharges.

For discussion purposes, water quality data for each of the five streams were examined in light of those standards established for Class "A" waters. This is an appropriate comparison considering the environment of the subject streams and the description of waters designated Class "A". "This classification is intended primarily to include waters or portions thereof located in areas of little habitation, no industrial development or intensive agriculture, and where the watershed is relatively undisturbed by man's activity." Beneficial uses of such waters may include drinking water supply (with treatment by disinfection only), wildlife propagation, agricultural use, recreation, boating, and esthetics. The degree to which

the five investigated streams provide such beneficial uses was not determined in this study.

In addition to the state-wide objectives enhancing Nevada's water quality, the Commission of Environmental Protection has established specific objectives for Class "A" waters within the State. A full account of these objectives is presented in Appendix H of this report. Those of particular interest to this discussion are summarized below:

Item	*Specification*
Dissolved Oxygen	Shall not be less than 6.0 milligrams per liter.
Fecal Coliform	FC concentration, based on a minimum of five samples during any 30-day period shall not exceed a geometric mean of 200 per 100 milliliters, nor shall more than 10 percent of total samples during any 30-day period exceed 400 per 100 milliliters.
pH	Range between 6.5 and 8.5.
Temperature	Shall not exceed 20°C.
Total Dissolved Solids	Shall not exceed 500 milligrams per liter or one-third above that characteristic of natural conditions (whichever is less).

SOURCE: *Environmental Reporter*

- *Badger Creek*

Badger Creek lies just east of the Surprise Valley and Lower Alkali Lake in the northwest corridor of Washoe County. Although identified as Cherry Creek on the 1970 edition of U.S. Geological Survey maps, the stream has been designated Badger Creek by the Surprise Resource Area headquarters of the Bureau of Land Management's Susanville District. Badger Creek drains the slopes of Hays Canyon Peak and, as an intermittent stream, joins Wall Creek in flowing to an internal drain or sump at the northern extreme of Duck Flat.

Data collected under the present study offer a guide to the general water quality of Badger Creek, and have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. Of the 35 parameters investigated for Badger Creek, 9 are subject to federal and/or state regulation: total coliform , fecal coliform, dissolved oxygen, pH, nitrate nitrogen, fluoride, total dissolved solids, temperature and turbidity. Other parameters indicative of water quality include benethic fauna, the ratio of fecal coliform to fecal streptococcus, and boron content. Badger Creek was sampled only once during the April high flow period.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Drinking water regulations are based on TC because their presence suggests fecal contamination by birds or mammals and that pathogenic viruses, bacteria, or protozoa of intestinal origin may be may be present also. Badger Creek samples contained 15,200 total coliform

per 100 milliliters for the high flow period, in significant excess of the federal limits. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

Fecal coliform (FC) objectives for Class "A" waters have been established by the Commission of Environmental Protection: Fecal coliform shall not exceed a geometric mean of 200 per 100 milliliters (based on at least 5 samples during any 30-day period); nor shall more than 10 percent of total samples taken during any 30-day period exceed 400 per 100 milliliters. Badger Creek meets this objective with 100 FC per 100 milliliters for the high flow period. However, this data value reflects limited sampling and requires confirmation with the recommended sampling frequency. The data value suggests that Badger Creek waters are safe for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 0.14, suggesting a predominance of livestock pollution.

The benthic fauna of Badger Creek sampled in the April high flow period were found to be dominated by freshwater worms (class Oligochaeta). These worms, possibly members of the family Haplotaxidae, contain red respiratory pigment that allow them to tolerate low dissolved oxygen conditions; they tend to inhabit waters with sluggish flow and muddy substrate. Badger Creek waters were highly turbid with relatively low dissolved oxygen values due to extensive bank degradation and erosion from livestock grazing. Because Badger Creek waters supported large numbers of annelids and very little else, it is likely that conditions of high sedimentation and low dissolved oxygen had existed for a significant period prior to sampling.

Class "A" objectives for dissolved oxygen concentrations are set at a minimum of 6.0 milligrams per liter, presumably relating to the beneficial use of these waters by fish and wildlife. The extent to which Badger Creek is utilized for these purposes was not determined in this study. Badger Creek waters were sampled and found to contain 8.2 milligams per liter of dissolved oxygen, at 100% saturation for the stream's temperature and elevation. No dissolved oxygen deficiency is evident from this measurement. Objectives for pH of Class "A" waters state that the range of ambient pH values should fall between 6.5 and 8.5 units. At the time of sampling, Badger Creek waters met this objective with a measured pH of 6.8 units.

The State of Nevada has adopted the federal drinking water standard for nitrate nitrogen of 10.0 milligrams per liter. No surface water objectives for nitrate have been set for Class "A" waters or Nevada waters in general. Badger Creek's observed level of nitrate nitrogen, 0.98 milligrams per liter for the high flow period, suggests no problem in this area.

Federal objectives for fluoride concentrations in domestic or municipal supply have been established and are reproduced within Appendix F. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling, fluoride data for Badger Creek cannot be related to Federal objectives. However, the fluoride level was observed to be very low: 0.11 milligrams per liter for the high flow period.

Dissolved solids in Badger Creek were observed to be 158 milligrams per liter (high flow), which is within the objective of 500 milligrams per liter set for Class "A" waters. Streams complying with Class "A" objectives for temperature will have waters of less than 20°C; Badger Creek was tested at 17.4°C in the April high flow period. No water quality problems are apparent from these data.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Badger Creek waters were observed to be very turbid at the time of sampling, with a recorded value of 66.0 NTU. There was evidence of extreme bank erosion in the sampling vicinity, with large mounds of fine soil along the stream.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. The boron concentration in Badger Creek was observed to be very low, with a high flow value of 0.08 milligrams per liter.

- *High Rock Creek*

High Rock Creek is located near the eastern border of Washoe County, north of State Highway 34. The intermittent waters of High Rock Creek originate in the northern Calico Mountains and flow generally southeasterly through a steep canyon to High Rock Lake in Humboldt County. The stream was visited once during the low flow period and was found to be virtually

static. Some ponding was observed from which samples and data were collected. High Rock Creek was not revisited during the high flow period.

Data collected under the present study offer a guide to the general water quality of High Rock Creek, and have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. Of the 27 parameters investigated for High Rock Creek, 8 are subject to federal and/or state regulation: total coliform, fecal coliform, pH, nitrate nitrogen, fluoride, total dissolved solids, temperature and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and boron content.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. High Rock Creek samples contained 76,000 total coliform per 100 milliliters for the low flow period, in significant excess of the federal limits. However, this is to be expected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

Fecal coliform objectives for Class "A" waters have been established by the Commission of Environmental Protection: fecal coliform shall not exceed a geometric mean of 200 per 100 milliliters (based on at least 5 samples during any 30-day period); nor shall more than 10 percent of the total samples taken during any 30-day period exceed 400 per 100 milliliters. High Rock Creek waters yielded 1,000 FC per 100 milliliters for the

low flow period. However, the data value reflects limited sampling and requires confirmation with the recommended sampling frequency. The data value suggests that, during negligible flow periods, High Rock Creek waters may conform to specified objectives for recreational swimming and other water-contact sports. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 0.50, suggesting a predominance of livestock pollution.

Low water flow precluded a quantitative sampling of the benthic fauna at High Rock Creek. Snails (Order Mesogastropoda) were observed at the sampling site and suggest an abundance of periphyton, algae, and organic debris, on which they feed. Water striders and small fish were also observed.

Objectives for pH of Class "A" waters state that the range of pH values should fall between 6.5 and 8.5 units. For the low flow sampling date, the pH of High Rock Creek waters was 6.2 units, slightly below the objective range.

The State of Nevada has adopted the federal drinking water standard for nitrate nitrogen of 10.0 milligrams per liter. No surface water objectives for nitrate have been set for Class "A" waters or Nevada waters in general. High Rock Creek's observed level of nitrate nitrogen, 0.59 milligrams per liter, suggests no problem in this area.

Federal objectives for fluoride concentrations in domestic or municipal supply have been established and are reproduced within Appendix F. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling,

fluoride data for High Rock Creek cannot be related to federal objectives. However, the fluoride level was observed to be low: 1.61 milligrams per liter for the low flow period.

Dissolved solids in High Rock Creek were recorded at a relatively high level: 450 milligrams per liter during the low flow period. This value falls within the objective of 500 milligrams per liter set for Class "A" waters. Streams complying with Class "A" temperature objectives will have waters of less than 20°C; High Rock Creek water temperature was measured at 17.5°C in the August low flow period. No water quality problems are apparent from these data.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. High Rock Creek values were well within these limits at 0.18 NTU for the low flow period. However, measurements were taken when the creek's discharge rate was negligible; increased turbidity may be expected during higher flows.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. The boron concentration within High Rock Creek was 0.32 milligrams per liter, suggesting no problem in this area.

- *Lost Creek*

Lost Creek springs from the foothills of the Granite Range in western Washoe County. The intermittent stream follows a light-duty road connecting State Highways 34 and 81, flowing in a generally easterly direction. Waters from Lost Creek serve to charge the groundwater system upon arrival in the vicinity of Duck Flat. Lost Creek was sampled twice--once during the low flow period of August 1977 and again in April 1978 for the high flow period.

Data collected under this study offer a guide to the general water quality of Lost Creek and have been presented previously within Tables 3, 4, 5A, 5B, and 6. Of the 34 parameters investigated for Lost Creek waters, 9 are subject to federal and/or state regulation: total coliform, fecal coliform, dissolved oxygen, pH, nitrate nitrogen, fluoride, total dissolved solids, temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and boron content.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Lost Creek samples contained 3,000 TC per 100 milliliters for the low flow sampling and 15,900 TC per 100 milliliters for the high flow sampling, both in excess of federal limits. However, this is not unexpected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

Fecal coliform (FC) objectives for Class "A" waters have been established by the Commission of Environmental Protection: Fecal coliform shall not exceed a geometric mean of 200 per 100 milliliters (based on at least 5 samples during any 30-day period); nor shall more than 10 percent of the total samples taken during any 30-day period exceed 400 per 100 milliliters. Lost Creek waters yielded 560 FC per 100 milliliters during the low flow period; a high flow value of 0 was recorded in April. Although the data suggest that Lost Creek waters may not always be safe for recreational swimming or other water-contact sports, these data do reflect limited sampling and require confirmation with the recommended sampling frequency. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 0.57, suggesting a predominance of livestock pollution. This observation was visually confirmed at the site, where cattle contamination was obvious.

The benthic macroinvertebrate community of Lost Creek showed large variations in numbers and species from the low flow to the high flow period. During low flow, Order Coleoptera (beetles) dominated with over 100 individuals per square foot. Since Coleoptera are rarely observed in streams of heavy sediment load, mud or sand bottoms, or of low oxygen content, their presence speaks for the generally high quality of Lost Creek waters (22). The high flow macroinvertebrates were quite sparse, with only three individuals during the April visit.

Class "A" objectives for dissolved oxygen concentrations are set at a minimum of 6.0 milligrams per liter, presumably relating to the beneficial use of these waters by fish and wildlife. The extent to which Lost Creek

is utilized for these purposes was not determined in this study. Lost Creek waters were sampled and found to contain 7.9 milligrams per liter of dissolved oxygen (95 percent saturation) for the low flow and 8.3 milligrams per liter (100 percent saturation) for the high flow period. No dissolved oxygen deficiency is evident from this data. Objectives for pH of Class "A" waters state that the range of acceptable pH levels is from 6.5 to 8.5 units. Lost Creek's pH values were observed to be at the lower limit of this range: 6.5 for the low flow and 6.6 for the high flow period, indicating compatibility with the objectives.

The State of Nevada has adopted the federal drinking water standard for nitrate nitrogen of 10.0 milligrams per liter. No surface water objectives for nitrate have been set for Class "A" waters or for Nevada waters in general. Lost Creek's observed levels of nitrate nitrogen, 0.72 milligrams per liter and 1.68 milligrams per liter for the respective low and high flows, suggest no problem in this area.

Federal standards for fluoride concentrations in domestic or municipal water supplies have been established and are reproduced within Appendix F. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the times of stream sampling, fluoride data for Lost Creek cannot be related to federal objectives. Nevertheless, fluoride levels were observed to be very low: 0.25 milligrams per liter and 0.13 milligrams per liter for the low and high flow periods, respectively.

Dissolved solids in Lost Creek waters were measured at 80 milligrams per liter (low flow) and 115 milligrams per liter (high flow). Class "A" objectives for total dissolved solids call for a maximum of 500 milligrams per liter; Lost Creek values are within this limit. Streams complying with temperature objectives of Class "A" waters will have a maximum temperature of 20°C. Lost Creek water temperatures were measured at 16.4°C during the low flow period and at 16.6°C during the high flow.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Lost Creek waters were somewhat turbid during the high flow period; recorded values were 1 NTU for the low flow and 17 NTU for the high flow. The stream banks were actively sloughing at the time of high flow sampling and erosion due to cattle was apparent.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. Boron concentrations in Lost Creek were observed to be very low: 0.02 milligrams per liter and 0.07 milligrams per liter for the respective low and high flow periods.

- *Wall Creek*

Wall Creek originates at Pinto Springs between the Calico Mountains and the Hays Canyon Range of northern Washoe County. As a perennial stream, Wall Creek flows generally southwesterly through Wall Canyon and joins

the intermittent flows of Bordwell Creek and Badger Creek in recharging the groundwaters of Duck Flat. Much of Wall Creek lies at elevations greater than 5,000 feet and is followed by an unimproved surface road connecting State Highways 34 and 81. Wall Creek was visited and sampled twice--once in August of 1977 and again in April of 1978.

Data Collected under this study offer a guide to the general water quality of Wall Creek and have been presented previously within Tables 3, 4, 5A, 5B, and 6. Of the 34 parameters investigated for Wall Creek waters, 9 can be compared to federal and/or state objectives: total coliform, fecal coliform, dissolved oxygen, pH, nitrate nitrogen, fluoride, total dissolved solids, temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and boron content.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Wall Creek samples contained 12,350 TC per 100 milliliters for the low flow and 5,900 TC per 100 milliliters for the high flow period, in significant excess of the federal limits. However, this is not unexpected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

Fecal Coliform (FC) objectives for Class "A" waters have been established by the Commission of Environmental Protection: Fecal coliform shall not

exceed a geometric mean of 200 per 100 milliliters (based on at least 5 samples during any 30-day period); nor shall more than 10 percent of the total samples taken during any 30-day period exceed 400 per 100 milliliters. Wall Creek meets this objective during the low flow period with 260 FC per 100 milliliters; a high flow value of 4 was recorded in April. The data suggest that Wall Creek waters are safe for recreational swimming and other water-contact sports. However, these data reflect limited sampling and require confirmation with the recommended sampling frequency. The source of the fecal contamination is indicated by the ratio of fecal coliform to fecal streptococcus bacteria: 0.19 and 0.02 for the respective low and high flow periods, suggesting a predominance of livestock pollution.

Wall Creek waters were quantitatively sampled for benthic fauna during both site visits. Four orders of animals were collected during low flow sampling and eight orders were observed during the high flow period. Mayflies numerically dominated both samples with 5 individuals per square foot during low flow and 111 animals per square foot during the high flow period. The high flow was especially rich in both species and numbers, in spite of relatively high turbidity (20 NTU) at the time of sampling. The presence of large numbers of mayfly nymphs indicates the correspondingly high photosynthetic productivity necessary to support these primary herbivores.

Class "A" objectives for dissolved oxygen concentrations are set at a minimum of 6.0 milligams per liter, presumably relating to the beneficial use of these waters by fish and wildlife. The extent to which Wall Creek is utilized for these purposes was not determined in this study. Wall

Creek waters were sampled and found to contain 7.5 milligrams per liter of dissolved oxygen (90 percent saturation) for the low flow and 8.9 milligrams per liter (100 percent saturation) for the high flow period. No dissolved oxygen deficiency is evident from this data. Objectives for pH of Class "A" waters state that the range of acceptable pH levels is from 6.5 to 8.5 units. Wall Creek's pH values were observed to be at the upper limit of this range: 8.3 for the low flow and 7.4 for the high flow period, indicating slightly alkaline waters.

The State of Nevada has adopted the federal drinking water standard for nitrate nitrogen of 10.0 milligrams per liter. No surface water objectives for nitrate have been set for Class "A" waters or for Nevada waters in general. Wall Creek's observed levels of nitrate nitrogen, 0.66 milligrams per liter and 0.33 milligrams per liter for the respective low and high flows, suggest no problem in this area.

Federal standards for fluoride concentrations in domestic or municipal water supplies have been established and are reproduced within Appendix F. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the times of stream sampling, fluoride data for Wall Creek cannot be related to federal objectives. Nevertheless, fluoride levels were observed to be very low: 0.46 milligrams per liter and 0.34 milligrams per liter for the low and high flow periods, respectively.

Dissolved solids in Wall Creek waters were measured at 174 milligrams per liter (low flow) and 156 milligrams per liter (high flow). Class "A" objectives for total dissolved solids call for a maximum of 500 milligrams per liter; Wall Creek values are within this limit. Streams complying with temperature objectives of Class "A" waters will have a maximum temperature of 20°C. Wall Creek water temperatures were 16.3°C during the low flow period and 18.0°C during the high flow period.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Wall Creek waters were somewhat turbid during the high flow period, recorded values were 0.26 NTU for low flow and 20.0 NTU for the high flow.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. Boron concentrations in Wall Creek were observed to be very low: 0.05 milligrams per liter and 0.11 milligrams per liter for the respective low and high flow periods.

- *Wall Canyon Creek*

Originating near Badger Mountain in the northeastern section of Washoe County, Wall Canyon Creek flows as an intermittent stream toward the Calico Mountains. It joins Hanging Rock Creek before following East Fork High Rock Canyon through the Calicos to High Rock Lake in Humboldt County. Wall Canyon Creek lies at altitudes between 5,000 and 6,000 feet. The

stream was visited once during the April high flow period and sampled for 34 biological, chemical, and physical parameters.

Data collected under the present study offer a guide to the general water quality of Wall Canyon Creek. These have been presented in the previous section within Tables 3, 4, 5A, 5B, and 6. Of the studied parameters, 8 are comparable to federal and/or state standards: total coliform, fecal coliform, pH, nitrate nitrogen, fluoride, total dissolved solids, temperature, and turbidity. Other parameters indicative of water quality include benthic fauna, the ratio of fecal coliform to fecal streptococcus, and boron content.

Federal drinking water limits for total coliform bacteria (TC) for communities and non-communities are set at either 1 or 4 TC per 100 milliliters (for the membrane filter technique), depending on the number of samples collected per month. Wall Canyon Creek waters contained 1,900 TC per 100 milliliters for the high flow period, exceeding the federal drinking water limits. However, this is not unexpected because coliforms are present in soils, animal droppings, and groundwaters. Antibacterial measures are required before waters may be deemed potable.

Federal coliform objectives for Class "A" waters have been established by the Commission of Environmental Protection: Fecal coliform shall not exceed a geometric mean of 200 per 100 milliliters (based on at least 5 samples during any 30-day period); nor shall more than 10 percent of the total samples taken during any 30-day period exceed 400 per 100 milliliters. Wall Canyon Creek met these objectives with a sampled concentration of 0 FC per

100 milliliters for the high flow period. However, this data value reflects limites sampling and requires confirmation with the recommended sampling frequency. The data value suggests that Wall Canyon Creek waters are safe for recreational swimming and other water-contact sports.

Benthic fauna surveys at Wall Canyon Creek revealed very few specimens, mostly Order Diptera (flies). Wall Canyon Creek flows through an arid region, which results in large seasonal variations in flow. These fluctuations may account for the lack of vegetation and scarcity of benthic fauna relative to other sampled streams. The Diptera collected were larvae of the family Tendipedidae (Chironomidae), a group which tolerates low dissolved oxygen and which is often diagnostic of this condition (18). Yet, the relatively low dissolved oxygen value of 8.8 milligrams per liter recorded for Wall Canyon Creek, however, is not significantly different from that recorded for Wall Creek which supported a rich variety of benthic fauna.

Class "A" objectives for dissolved oxygen concentrations are set at a minimum of 6.0 milligrams per liter, presumably relating to the beneficial use of these waters by fish and wildlife. The extent to which Wall Canyon Creek is utilized for these purposes was not determined in this study. Wall Canyon Creek waters were sampled and found to contain 8.8 milligrams per liter of dissolved oxygen (100 percent saturation) for the high flow period. No dissolved oxygen deficiency is evident from this data. Objectives of pH of Class "A" waters state that the range of acceptable pH levels is from 6.5 to 8.5 units. The pH of Wall Canyon Creek's waters was observed to be at the lower end of this range: 6.7 for the high flow period.

The State of Nevada has adopted the federal drinking water standard for nitrate nitrogen of 10.0 milligrams per liter. No surface water objectives for nitrate have been set for Class "A" waters or Nevada waters in general. The observed level of nitrate nitrogen in Wall Canyon Creek waters, 0.48 milligrams per liter, suggests no problem in this area.

Federal objectives for fluoride concentrations in domestic or municipal water supplies have been established and are reproduced within Appendix G. Concentration limits are set for the annual average of maximum daily air temperatures, based on temperature data obtained for a minimum of 5 years. Because air temperatures were measured only at the time of stream sampling, fluoride data for Wall Canyon Creek cannot be related to federal standards. However, the fluoride level was observed to be very low: 0.18 milligrams per liter for the high flow period.

Total dissolved solids in waters of Class "A" distinction are limited to a maximum of 500 milligrams per liter. Wall Canyon Creek held 109 milligrams of dissolved solids per liter when sampled in the April high flow period. Streams complying with Class "A" temperature objectives will have waters of less than 20°C; Wall Canyon Creek's water temperature was 18.7°C. No water quality problems are apparent from the data value.

Turbidity in drinking water is regulated by federal standards with the setting of maximum levels: 1 Turbidity Unit (nephelometric method) monthly average and 5 Turbidity Units average of 2 consecutive days. Wall Canyon Creek waters were somewhat turbid at 18.0 NTU for the high flow period.

Although no standards or objectives have been set for boron, waters used for irrigation are considered injurious or unsatisfactory for most crops when their boron content exceeds 2 milligrams per liter. The boron concentration within Wall Canyon Creek waters was 0.07 milligrams per liter, suggesting no problems in this area.

ACKNOWLEDGEMENTS

We acknowledge and greatly appreciate the assistance provided by Mr. Bob Adams of the Ukiah District Office, Mr. Bob House of the Redding District Office, and Mr. Don Wilbur of the Surprise Resource Area Office of the Susanville District, Bureau of Land Management.

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APPENDIX A

EXPENDITURES

EXPENDITURES

A summary of expenditures for this Water Qualitv Monitoring Study from project initiation to 10 October 1978 is presented below. All expenses associated with field and laboratory investigations, data analyses, and draft and final report preparations are included herein.

FUNDS EXPENDED AS OF 15 SEPTEMBER 1978

CONTRACT NO. YA-512-CT7-163

TETRA TECH CONTRACT NO. TC-3887

ITEM	EXPENDITURE
LABOR	$ 38,280
LABORATORY ANALYSIS	5,548
MATERIALS	1,885
EQUIPMENT	2,047
TRAVEL	4,965
TOTAL	$ 52,725

132

52,725 ✓ OK

APPENDIX B

FIELD EQUIPMENT

TABLE B. *Field Equipment*

Type of Investigation	*Equipment description*
BIOLOGICAL	Surber sampler
	Aluminum pan
	Forceps
	37% W/V formaldehyde
	Sample storage jars
	Biological labels
	Millipore filter holder assembly
	Millipore sterile petri dishes
	Millipore sterile absorbent pads
	Millipore smooth-tipped forceps
	Millipore HC filters
	Millipore MF-Endo medium (ampoules)
	Millipore M-FC medium (ampoules)
	Millipore KF Agar medium (dehydrated)
	1% W/V 2, 3, 5-triphenyltetrozolium chloride (TTC)
	Millipore ampoule breaker
	Millipore 1 ml sterile pipettes
	Absolute methanol
	Millipore Millex filter units
	Millipore 50 ml syringes
	Sterile phosphate buffer
	Millipore portable incubator

continued next page

TABLE B (Cont'd.). *Field Equipment*

Type of Investigation	*Equipment description*
BIOLOGICAL	Millipore MF aluminum block incubator
	12 volt, 48 amp batteries (2)
	Battery charger
	Illuminating hand lens
CHEMICAL	Burettes
	Burette holder
	Burette stand
	Corning Model 610A Expandable Portable pH meter
	Corning pH probes
	Biochemical oxygen demand bottles
	Ehrlenmeyer flasks (250 ml and 500 ml)
	Graduated cylinders
	Funnels
	Volumetric pipettes
	Beakers
	Hach alkaline iodide-azide powder pillows
	Hach manganous sulfate powder pillows
	Concentrated sulfuric acid
	Standardized 0.1N sodium thiosulfate (preserved with chloroform)

continued next page

TABLE B (Cont'd.). *Field Equipment*

Type of Investigation	*Equipment description*
CHEMICAL	Starch indicator solution
	Corning pH 4.01 and pH 7.00 buffer solutions
	Standardized 1.0N sulfuric acid
PHYSICAL	US DH[a]-48 sediment sampler
	US DH-59 sediment sampler
	Sediment sampler rods
	Sample bottles with caps
	Helley-Smith bed load sampler with bags
	US BMH[b]-53 bed material sampler
	Shovel
	Trowel
	Price flow meter
	Price Pygmy flow meter with rod, headset, and battery
	100 ft tapes
	Collapsible wooden ruler
	Stopwatch
	HF Instruments Model DRT-15 turbidimeter
	Yellowstone Scientific Instruments Model 33 S-C-T conductivity meter
	Surveying level, tripod, and rod

continued next page

TABLE B (Cont'd.). *Field Equipment*

Type of Investigation	*Equipment description*
MISCELLANEOUS	Canon 35mm camera and kit
	Sledge hammer
	Orange-painted marker pipes
	Fire extinguisher
	Boots, waders, and flotation safety vests

[a]United States Depth Integrating Hand Held.

[b]United States Bed Material Hand Held.

APPENDIX C

DETAILS OF PHYSICAL MEASUREMENTS

DETAILS OF PHYSICAL MEASUREMENTS

Cross-Section and Streamflow

Streamflow was measured after establishing a cross-section in accordance with U.S. Geological Survey (USGS) guidelines (1). A straight channel reach was required without constrictions or obstacles; the banks were as free as possible of erosion; and the flow was without ponding or backwater from downstream tributaries or other sources. Stream velocity and depth determined whether a particular stream location was wadable and therefore suitable for establishing a cross-section.

After the proper location for a cross-section was determined, a plastic tape marked in 0.1 foot intervals was stretched across the stream perpendicular to the flow and anchored securely at each bank. Fifteen to twenty equal increments were chosen and noted on a flow sheet, and stream depth was recorded at each increment to the nearest 0.05 foot. At each vertical in the cross-section discharge measurements were made following USGS criteria (2). Discharge measurements were made using the current-meter method, which consists of determinations of velocity and area in the parts of a stream cross-section. At each vertical, observations are recorded relating the distance to a reference point on the bank, the depth of flow, and the velocity as indicated by the current marked at one or two points in the vertical. Because nearly all verticals were less than 2 feet in depth, the 1-point method was used as outlined in the Water Measurement Manual of the U.S. Bureau of Reclamation (3). Flow

measurements were therefore taken at about six tenths total depth, this depth taken to be the mean velocity in the vertical. The discharge in each partial section was calculated to be the product of mean velocity times depths of the vertical times the sum of half the distances to adjacent verticals. The sum of the discharges in all the partial sections was the total discharge of the stream.

Flow measurements taken by the current meter method involve wading the stream with a current meter which slides on a graduated metal rod and timing the number of revolutions of a bucket wheel set at a predetermined depth (six tenths total depth). The essential features of a current meter are a wheel which rotates when immersed in flowing water and a device to determine the number of revolutions of the wheel. The Price meter and Price pygmy meter used on this survey are cup-type instruments with vertical axes which were developed by USGS. The Price-type meters have the following general features: vanes to keep the wheel headed into the current, a graduated metal rod for handling the meter, a rotor with a vertical axis and six cone-shaped cups, an electrical device for signaling the number of revolutions, and connections from the current meter to a 1 1/2-volt battery-powered headphone. (Because nearly all of the streams on this survey were clear and reasonably slow-flowing, both Price meters had painted cups and a visual count was made of the number of revolutions. In turbid or fast-flowing, wadable water, the earphones were used.) The Price current meter was used to observe velocity, except in shallow depths where the pygmy (2/5 the size of the

Price) meter was used. The pygmy meter, with a bucket wheel 2 inches in diameter compared with 5 inches with the conventional Price meter, is limited to velocities up to 3 or 4 feet per second and is used to supplement the Price meter in shallow areas of a stream. Each meter is individually calibrated in the rating flume at the National Bureau of Standards. After depth, velocity, and time in seconds were recorded total flow was computed for each stream.

Bed Material

Bed material consists of sedimentary material at rest on a stream floor. Stream floor sediments range in size from boulder to silt and clay, but are generally finer than 30 or 40 millimeters in diameter. Particle size is an important textural element of sedimentary material because it is related to the dynamic conditions of transportation and deposition (4). In sampling bed material the size distribution of particles and the quantity of sample determines the equipment used. In analyzing sediments in the lab the most common method of measuring particle size is by sieving.

For this study two pieces of equipment were used to obtain samples. Where the sediment consisted of material smaller than pebble (less than 4 millimeters in diameter) an F.I.A.S.P.-approved bed material sampler, the US BMH-53, was used. For larger material a hand trowel was used.

The US BMH-53 is a hand-held piston-type sampler that was designed to sample material finer than medium gravel from the bed of a wadable stream.

It is 46 inches in total length, tubular in shape, and usually made of corrosion resistant materials. The lower end of the sampler contains a cylinder 2 inches in diameter and 8 inches long which is pressed into the streambed to collect the sample. A handle for pressing the cylinder into the bed is located at the top of the sampler frame. A piston rod with a handle on its upper end passes through the sampler frame to the piston inside the cylinder. The piston is retracted when the cylinder is pressed into the bed material and suction is created by the piston holds the sample in the cylinder. The sample is pushed out of the cylinder by the piston and stored (5).

Bed material samples were collected at several locations in the cross-section across each stream. A sample was taken on each bank, generally within 1 to 3 feet of the water's edge and at the extremes of flow regimes within the channel. After collection by trowel or piston corer, each sample was placed in a plastic zip-loc bag, labelled, and sealed for later analysis in the lab. Approximately four samples were taken from each stream.

Laboratory analysis of bed material samples involved washing the sample into an aluminum tray and drying in a Soiltest oven at 200°F overnight. Samples containing a high percentage of mud were dried at a lower temperature for a longer period of time. Samples high in organic material were weighed and treated with a 3 percent solution of H_2O_2 after oven drying. Approximately 100 milliliters of distilled water and 300 to 400 milliliters of H_2O_2 (depending on the amount of sample) were added to each aluminum tray. These were replaced in the oven at a temperature of 100°F until dry.

After drying the samples were disaggregated with a plastic spoon and weighed on a Sartorius top-loading balance to an accuracy of 0.1 gram. For samples greater than about 250 grams of fine material, sediments were halved using a Sepor portasplitter and reweighed. A sieve analysis was then performed on one of the samples chosen at random.

A sieve analysis is a mechanical separation method whereby a sample of known weight is passed through a nested set of sieves of decreasing mesh size and weighing the amounts retained on each sieve. The grade scale most commonly used for sediments is the Wentworth scale which was established in 1922 and gives descriptive class terms for various sizes of sedimentary particles. The Wentworth is a logarithmic scale in which each grade limit is twice as large as the next smaller limit. The phi ϕ scale was devised by Krumbein and is a logarithmic transformation of the Wentworth grade scale based on the negative logarithm to the base 2 of the particle diameter. A copy of the Wentworth scale and Krumbein's transformation of it is included in Appendix E.

A sieve analysis consisted of a visual inspection of the sample to determine the predominant descriptive class term of the sediment, whether coarse sand, fine sand, silt, etc. Because of the wide range of sizes of material, intervals of 1ϕ were used in most cases. After selecting an appropriate range of U.S. Standard sieves the weighed samples were shaken mechanically for 15 minutes on a Tyler portable sieve shaker. This apparatus shakes six sieves and a pan at one time. These 7 size fractions were then weighed individually to an accuracy of 0.1 gram and

recorded on a data sheet. The total weight of the size fractions was found and the amount of sample lost and its percentage of the total was calculated. In all sieving some sediment is always lost (especially in samples which are predominantly very fine sand or silt), and in most cases this loss was less than 2 percent of the total weight of the original sample. This loss was recorded on each data sheet. Also recorded on the data sheet is the percent by weight of each size fraction and the cumulative percent total by decreasing size.

Bed Load

Bed load is the coarse fraction of suspended sediment in streamflow which slides, rolls, or bounces along in almost continuous contact with the streambed. These particles progress downstream through alternating periods of movement and rest and move within a 0.25 foot zone of the bed. A close relationship exists between the bed load and bed material because while a particle is moving it is part of the bed load; once it stops moving it becomes bed material. The size distribution of bed load, however, is generally finer than that of bed material.

Bed load sediment moves at velocities less than the surrounding flow, these velocities often varying considerably with respect to both space and time. For this reason a bed load sample may not be representative of the entire cross-section for a reasonable interval of time. As stated in *Field Methods for Measurement of Fluvial Sediment*, "the bedload discharge...cannot be determined in the same manner as suspended sediment

loads through computation by use of suspended concentration and water discharge data" (1). For this study only one flow-weighted bed load sample was taken.

To obtain a bed load sample a Helley-Smith bed load sampler was used. This sampler, which is currently under investigation by USGS, is approximately 3 feet long, 65 pounds in weight, and has a 3¼ inches in aperture. A 0.25 millimeter mesh nylon triangular-shaped bag fits over the rear of the aperture and is tied to the tail section of the sampler. The Helley-Smith is used in streams where "the median diameter of the bed material (D_{50}) is between 2 and 8 millimeters (very fine to fine gravel), the range of bed material sizes is relatively narrow and bed forms, flow depths, and velocities permit controlled placement and retrieval of the samples" (6).

The Helley-Smith was placed in the stream in a position where a flow-weighted sample could be obtained and where the stream bottom was flat and free from obstruction. A timed sample of from 1 to 5 hours was taken. After removal from the stream the bag was detached and air dried overnight. The sample was removed from the bag by shaking onto a clean flat surface and by brushing with a small paint brush. Storage for the sample was in a labelled zip-loc plastic bag.

Analysis of the Helley-Smith sample involved weighing the sample on a Sartorius top-loading balance to an accuracy of 0.1 gram and digesting organic material in a 3 percent solution of H_2O_2. After oven-drying at 100°F the sample was reweighed and the weight of material transported per unit time was calculated.

Suspended Sediment

Suspended sediment refers to the smaller sediment particles held in suspension by turbulent currents in a stream. In general these particles are distributed uniformly throughout the vertical, the finer sediments moving downstream at about the same velocity as the water. Coarse sediments are found closer to the streambed and are regarded as bed load and unmeasured load. Bed load is the larger material that rolls, skips, and bounces along in almost constant contact with the streambed. Unmeasured load is the sediment which lies above the range of bed load (0.30 foot) and below the range of suspended sediment (0.30 foot). Sampling for material in suspension followed USGS guidelines (1). Samples were taken using an F.I.A.S.P.-approved suspended sediment sampler. Streams too fast flowing to obtain a sample with the US DH-48 had no gauging station or bridge nearby where a heavier sampler, such as the US DH-59, could be used. Slow flowing, shallow streams were measured by immersing the bottle into the stream. These samples were analyzed but gravimetric figures for suspended sediments given in Table 7 are probably more accurate. Only measurements using the ETR method are included in Table 7 under "Suspended Sediments ETR."

The US DH-48 is a lightweight hand sampler weighing 4½ pounds (2 kilograms) consisting of a streamlined aluminum casing 13 inches (33 centimeters) long. A pint glass milk bottle fits underneath the sampler and rests against a rubber gasket at the head of the casing. Water enters the sampler through a calibrated ¼ inch (inside diameter) intake nozzle and is discharged into the bottle. Sampling with the US DH-48 obtains

a sample to within 0.3 foot of the streambed. Below this zone a bed load sampler was used.

After a cross-section was established traversing the stream and flow was measured, a flow-weighted suspended sediment sample was taken. Only one suspended sediment sample was taken because of cost factors and because most streams appeared to have a stable cross-section and a rather uniform lateral suspended sediment distribution. After orientation of the sampler in the stream (at a flow-weighted point), depth integration was accomplished by lowering the sampler to the streambed at a constant or uniform transit rate. The equal transit rate (ETR) method was used whereby the sample was lowered to the streambed and raised at a constant rate and timed.

Generally, the ETR method employs the use of many verticals to obtain suspended sediment-discharge measurements, but cost factors limited the number of suspended sediment samples taken. Flow was measured by other methods.

Primarily, suspended sediment samples were used to determine the amount of suspended material for a given volume of water. Laboratory analysis of each sample employed a variation of the standard filtration technique (7). Instead of a Gooch crucible, the membrane filtration technique was used utilizing the apparatus in Millipore's Field Water Test Kit. This kit consists of a field-sterilization filter holder assembly and a valved syringe used as a vacuum pump. A 0.45 micron 47 millimeter Millipore disc filter was numbered and weighed on a Metler H34 balance

to an accuracy of 0.0001 gram. The filter was subsequently rinsed with distilled water, placed in a plastic petri dish, dried at 100°F in a Soiltest oven for 2 hours and placed in a dessicator overnight. The dried filters were then reweighed and placed on the stainless steel filter holder assembly of the Millipore field water test kit. The suspended sediment samples in the milk bottle were emptied into a graduated cylinder, measured, and the volume was recorded. After emptying into the stainless steel funnel all sample containers and the filter holder assembly were rinsed with distilled water to ensure that all sediment reached the filter. The filter was removed, placed in a petri dish and dried in the oven overnight at 100°F. The filter was again placed in a dessicator overnight. After weighing on the Metler balance, the concentration in milligrams per liter was calculated.

Suspended sediment concentration was determined following USGS guidelines (8). Sediment concentration is the ratio of the weight of the sediment to the volume of water. For suspended sediment samples using the ETR method, sediment concentration is measured in terms of sediment weight per volume of water per unit time.

Turbidity

Turbidity measurements were taken with an HF Instruments (Bolton, Ontario, Canada) DRT-15 portable battery operated turbidimeter. This instrument consists of a small well with a light source, sensor and cap, and a dial readout. The instrument reads the amount of light passing through a sample placed in a glass cuvet and deposited in the well.

After calibrating the turbidimeter with a reference standard supplied with the instrument which is set at 0.12 nephelometric turbidity unit, a sample of stream water was collected from near the bank and placed in a screw-capped glass cuvet. This sample bottle was wiped dry and all fingerprints were removed before placing it in the well and attempting a reading.

The HF Instruments Turbidimeter has a switch to control 3 ranges of turbidity: 0-1, 0-10, and 0-100 nephelometric turbidity units. In the present study most readings were in the 0-1 range, but 1 reading, that for Hulls Creek, ran off the highest scale.

Literature Cited (Within Appendix C)

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APPENDIX D

INDICATOR BACTERIA

FOR

WATER QUALITY

INDICATOR BACTERIA FOR WATER QUALITY

The indicator bacteria measured in the present investigation were total coliform (TC), fecal coliform (FC), and fecal streptococcus (FS). Densities were determined with respect to 100 milliliters of sampled water, the standard volume for established drinking water criteria (see Discussion and Appendix E). While not harmful themselves, these bacteria indicate by their presence that pathogenic viruses, bacteria, or protozoa of intestinal origin may also be present in the sampled water (1,2).

Each type of indicator bacteria has its special application. Drinking water standards are based only on TC because their presence alone opens the possibility of fecal contamination by birds or mammals, including humans. However, TC are universally present in soils, vegetation, and therefore in streams totally free of avian or mammalian fecal contamination. For this reason TC provide no information concerning either the presence of fecal contamination or its source.

In cases where a more precise determination of contamination sources is required, FC and FS measurements are conducted. Unless cultured in the laboratory, FC bacteria live only in the intestines of birds and mammals, and they survive for a much shorter time in water than do other coliforms (1). Their presence in a water sample therefore provides strong evidence of recent fecal contamination. FS bacteria are also confined to avian and mammalian intestines unless cultured; they provide a confirmation of fecal contamination and can be used with FC bacteria to

indicate the likelihood of a human source versus a non-human (poultry livestock) source (2).

The FC-FS ratio is a significant analytical tool resulting from increased use of FS testing in water quality investigations (2). The measured densities of FC and FS bacteria are set in proportion as follows:

$$\frac{\text{FC per 100 milliliters}}{\text{FS per 100 milliliters}} = \text{ratio}$$

The following limitations apply to the construction of this ratio (2):

- The samples must be taken at the same station at the same time, not more than 24 hours downstream from the source of contamination.

- The pH of the sampled water must lie between 4.0 and 9.0.

- Only FC (not TC) can yield a valid ratio.

The value of the ratio, under the stipulated limitations, can indicate the likelihood of human contamination. This is useful because human feces are more likely than non-human wastes to contain pathogens which are dangerous to humans. If the FC count is two or more times the FS count, human pollution is indicated because FC bacteria are more likely to arise in large numbers from human wastes than from the feces of

poultry or livestock. By converse, a larger FS count indicates the likelihood of non-human contamination (2).

The following ratio values serve as interpretive guidelines (2):

$\frac{FC}{FS} > 4$: Human pollution is strongly indicated.

$2 < \frac{FC}{FS} < 4$: A predominance of human wastes in mixed pollution may exist.

$1 < \frac{FC}{FS} < 2$: Interpretation is uncertain.

$\frac{FC}{FS} < 1$: A predominance of poultry or livestock pollution is indicated.

FC-FS ratios of 3.00 and 3.13 were obtained for the Willow Creek tributary and Bare Creek, respectively, during the low-flow period of the present investigation (see Table 3). Based on firsthand knowledge of the sampling area, these ratios were interpreted as indicating livestock pollution rather than to predominantly human pollution. The lower 2.00 ratio obtained during the low-flow period for Butte Creek (Ukiah District) upstream from the De Sabla Power Station was interpreted as uncertain, however, because the region including and north of De Sabla receives heavy recreational use and livestock were not observed in the vicinity.

Literature Cited (Within Appendix D)

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APPENDIX E

BOTTOM MATERIAL

SIZE COMPOSITION

BOTTOM MATERIAL SIZE COMPOSITION

Introduction

The following tables present the results of sieve analyses run on bottom material samples taken from each stream. In the cases where a Helley-Smith sample was taken, additional data sheets are provided. Sieve analyses are important in determining stream hydraulic conditions, i.e., transportation and deposition. Where a stream is fast-flowing there is a tendency to carry larger material; where flow is slower and lighter, smaller material may be found. For this reason and the relationship to erosion, grain size analyses are important to environmental and water quality studies.

Accompanying the data sheets is a table of grain size scales for sediments. This is a universal scale for sediment work and is taken from Folk. This table gives the relationship between sieve mesh size, millimeters, phi, and the Wentworth size class for each grain size. Sizes for stream bottom material ranged from -2.0ϕ to 4.0ϕ (4.0 millimeters to 0.0625 millimeter) in intervals of 1ϕ. Where possible, a narrower more accurate range of $\frac{1}{2}\phi$ was used. No hydrometer or pipette analyses were run for material smaller than 4.0ϕ.

GRAIN SIZE SCALES FOR SEDIMENTS

The grade scale most commonly used for sediments is the Wentworth (1922) scale which is a logarithmic scale in that each grade limit is twice as large as the next smaller grade limit. The scale starting at 1mm and changing by a fixed ratio of 2 was introduced by J. A. Udden (1898), who also named the sand grades we use today. However, Udden drew the gravel/sand bourdant at 1mm and used different terms in the gravel and mud divisions. For more detailed work, sieves have been constructed at intervals $\sqrt[2]{2}$ and $\sqrt[4]{2}$. The ∅ (phi) scale, devised by Krumbein, is a much more convenient way of presenting data than if the values are expressed in millimeters, and is used almost entirely in recent work.

U.S. Standard Sieve Mesh #	Millimeters	Microns	Phi (∅)	Wentworth Size Class	
	4096		-12		
	1024		-10	Boulder (-8 to -12∅)	
Use	256		- 8		
wire	64		-6	Cobble (-6 to -8∅)	
squares	16		-4	Pebble (-2 to -6∅)	GRAVEL
5	4		-2		
6	3.36		-1.75		
7	2.83		-1.5	Granule	
8	2.38		-1.25		
10	2.00		-1.0		
12	1.68		-0.75		
14	1.41		-0.5	Very coarse sand	
16	1.19		-0.25		
18	1.00		0.0		
20	0.84		0.25		
25	0.71		0.5	Coarse sand	
30	0.59		0.75		
35	1/2 — 0.50	500	1.0		SAND
40	0.42	420	1.25		
45	0.35	350	1.5	Medium sand	
50	0.30	300	1.75		
60	1/4 — 0.25	250	2.0		
70	0.210	210	2.25		
80	0.177	177	2.5	Fine sand	
100	0.149	149	2,75		
120	1/8 — 0.125	125	3.0		
140	0.105	105	3.25		
170	0.088	88	3.5	Very fine sand	
200	0.074	74	3.75		
230	1/16 — 0.0625	62.5	4.0		
270	0.053	53	4.25		
325	0.044	44	4.5	Coarse silt	
	0.037	37	4.75		
	1/32 — 0.031	31	5.0		MUD
	1/64 0.0156	15.6	6.0	Medium silt	
Analyzed	1/128 0.0078	7.8	7.0	Fine silt	
by	1/256 0.0039	3.9	8.0	Very fine silt	
	0.0020	2.0	9.0		
Pipette	0.00098	0.98	10.0	Clay	
	0.00049	0.49	11.0		
or	0.00024	0.24	12.0		
	0.00012	0.12	13.0		
Hydrometer	0.00006	0.06	14.0		

Reference: Folk, R.L., 1974. Petrology of Sedimentary Rocks. Hemphill Publishing Co., Austin, Texas. 182 p.

UKIAH DISTRICT

SAMPLE LOG SHEET

Bear Cr. (trowel; bank matl.; left bank looking upstream; 3 ft. from water's edge)

1. Sample No. 1 2. Analyst MO 3. Date 5/1 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 279.0g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		168.2	60.6	60.6
-1.5	2.83	7		21.0	7.6	68.2
-1.0	2.0	10		18.4	6.6	74.8
-0.5	1.41	14		13.3	4.8	79.6
0.0	1.0	18		6.9	2.5	82.1
0.5	0.71	25		3.3	1.2	83.3
PAN	<0.71			46.4	16.7	100.0
			total	277.5		

Comments: Lost 1.5g (0.5%) of sample in sieving.

SAMPLE LOG SHEET

Bear Cr. (trowel; 60 ft. location)

1. Sample No. 2 2. Analyst MO 3. Date 5/2 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 248.2g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		206.5	83.6	83.6
-1.0	2.0	10		20.9	8.5	92.1
0.0	1.0	18		5.4	2.2	94.3
1.0	0.50	35		3.7	1.5	95.8
2.0	0.25	60		5.6	2.3	98.1
3.0	0.125	120		3.6	1.4	99.5
PAN	<0.125			1.3	0.5	100.0
			total	247.0		

Comments: Lost 1.2g (0.5%) of sample in sieving.

SAMPLE LOG SHEET

Bear Cr. (trowel; 48 ft. location)

1. Sample No. 3 2. Analyst MO 3. Date 5/3 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 239.0g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		194.0	81.5	81.5
-1.0	2.0	10		23.0	9.7	91.2
0.0	1.0	18		7.7	3.2	94.4
1.0	0.50	35		7.5	3.2	97.6
2.0	0.25	60		3.3	1.4	99.0
3.0	0.125	120		1.7	0.7	99.7
PAN	<0.125			0.7	0.3	100.0
			total	237.9		

Comments: Lost 1.1g (0.5%) of sample in sieving.

SAMPLE LOG SHEET

Bear Cr. (trowel; 20 ft. location)

1. Sample No. 4 2. Analyst MO 3. Date 5/2 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 216.7g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		159.5	73.9	73.9
-1.0	2.0	10		20.2	9.4	83.3
0.0	1.0	18		14.9	6.9	90.2
1.0	0.50	35		17.8	8.2	98.4
2.0	0.25	60		2.5	1.2	99.6
3.0	0.125	120		0.6	0.3	99.9
PAN	<0.125			0.3	0.1	100.0
			total	215.8		

Comments: Lost 0.9g (0.4%) of sample in sieving.

SAMPLE LOG SHEET

Bear Cr.

1. Sample No. HS 2. Analyst MO 3. Date 5/23 4. Summary of Preliminary Treatment, Dispersal, etc. Sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 1.0g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 0.9g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				

Comments: Added 10 ml. of 3% H_2O_2 to dissolve organic matl.

SAMPLE LOG SHEET

Bear Canyon Cr. (Cover near 7 ft. location)

1. Sample No. 1 2. Analyst MO 3. Date 5/8 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 138.0 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		101.5	73.9	73.9
-1.0	2.0	10		14.8	10.8	84.7
0.0	1.0	18		10.8	7.8	92.5
1.0	0.50	35		8.1	5.9	98.4
2.0	0.25	60		1.2	0.9	99.3
3.0	0.125	120		0.6	0.4	99.7
PAN	<0.125			0.4	0.3	100.0
			total	137.4		

Comments: Lost 0.6g (0.4%) of sample in sieving.

SAMPLE LOG SHEET

Bear Canyon Cr. (trowel; near 15 ft. location looking upstream)

1. Sample No. 2 2. Analyst MO 3. Date 5/8 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on a Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 249.7 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
* -2.0	4.0	5		188.5	75.8	75.8
-1.0	2.0	10		16.5	6.6	82.4
0.0	1.0	18		19.5	7.8	90.2
1.0	0.50	35		18.1	7.3	97.5
2.0	0.25	60		3.1	1.3	98.8
3.0	0.125	120		1.6	0.6	99.4
PAN	<0.125			1.4	0.6	100.0
			total	248.7		

Comments: Lost 1.0g (0.4%) of sample in sieving.

* Includes one large rock weighing 71.9g.

SAMPLE LOG SHEET

Bear Canyon Cr. (trowel; 5 ft. from water; right bank looking upstream)

1. Sample No. 3 2. Analyst MO 3. Date 5/9 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 197.2 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		111.5	56.9	56.9
-1.0	2.0	10		13.3	6.8	63.7
0.0	1.0	18		13.8	7.0	70.7
1.0	0.50	35		29.0	14.8	85.5
2.0	0.25	60		13.3	6.8	92.3
3.0	0.125	120		10.7	5.5	97.8
PAN	<0.125			4.4	2.2	100.0
			total	196.0		

Comments: Lost 1.2g (0.6%) of sample in sieving.

SAMPLE LOG SHEET

Bear Canyon Cr.

1. Sample No. HS 2. Analyst MO 3. Date 4/23 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1 g

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 0.1 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 0.0 g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				

Comments: Added 2 ml of 3% H_2O_2 to dissolve organic matl.

SAMPLE LOG SHEET

Butte Cr. left branch (trowel; 5' from water's edge; left bank matl. looking upstream)

1. Sample No. 1 2. Analyst MO 3. Date 4/26 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1 g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 232.2g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		121.2	52.5	52.5
-1.0	2.0	10		27.7	12.0	64.5
0.0	1.0	18		21.5	9.3	73.8
1.0	0.50	35		24.8	10.8	84.6
2.0	0.25	60		14.1	6.1	90.7
3.0	0.125	120		13.6	5.9	96.6
PAN	<0.125			7.9	3.4	100.0
			total	230.8		

Comments: Lost 1.4g (0.6%) of sample in sieving.

SAMPLE LOG SHEET

Butte Cr. left fork (trowel; midstream)

1. Sample No. 2 2. Analyst MO 3. Date 4/26 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 272.7g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		164.1	60.5	60.5
-1.0	2.0	10		28.1	10.4	70.9
0.0	1.0	18		27.5	10.1	81.0
1.0	0.50	35		33.2	12.3	93.3
2.0	0.25	60		8.6	3.2	96.5
3.0	0.125	120		5.8	2.1	98.6
PAN	<0.125			3.9	1.4	100.0
			total	271.2		

Comments: Lost 1.5g (0.6%) of sample in sieving.

SAMPLE LOG SHEET

Butte Cr. left branch (trowel; 2ft. from water's edge; right bank looking upstream)

1. Sample No. 3 2. Analyst MO 3. Date 5/3 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1 g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 250.4g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		138.8	55.9	55.9
-1.0	2.0	10		30.6	12.3	68.2
0.0	1.0	18		18.9	7.6	75.8
1.0	0.50	35		17.2	6.9	82.7
2.0	0.25	60		8.2	3.3	86.0
3.0	0.125	120		14.6	5.9	91.9
Pan	<0.125			20.0	8.1	100.0
			total	248.3		

Comments: Lost 2.1g (0.8%) of sample in sieving.

SAMPLE LOG SHEET

Butte Cr. right branch

1. Sample No.____ 2. Analyst____ 3. Date____ 4. Summary of Preliminary Treatment, Dispersal, etc.____

5. Dispersant added____; Concentration____; Vol.____

6. Weight of untreated sample____

7. Weight of sample after removal of carbonates, organic matter, iron oxides____

8. Pipette analysis; needed____; performed____

9. Settling tube; needed____; performed____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
	Material too rocky to sample.					

Comments:

SAMPLE LOG SHEET

Cedar Cr. (trowel; left bank looking upstream ; 5 ft. from water's edge)

1. Sample No. 1 2. Analyst MO 3. Date 5/11 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 279.0g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		191.2	68.9	68.9
-1.0	2.0	10		21.8	7.9	76.8
0.0	1.0	18		18.3	6.6	83.4
1.0	0.50	35		25.9	9.3	92.7
2.0	0.25	60		8.6	3.1	95.8
3.0	0.125	120		6.8	2.5	98.3
PAN	<0.125			4.7	1.7	100.0
			total	277.3		

Comments: Lost 1.7g (0.6%) of sample in sieving.

SAMPLE LOG SHEET

Cedar Cr. (trowel; 8 ft. location)

1. Sample No. 2 2. Analyst MO 3. Date 5/18 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 367.2g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		270.3	73.7	73.7
-1.0	2.0	10		24.9	6.8	80.5
0.0	1.0	18		10.6	2.9	83.4
1.0	0.50	35		23.7	6.5	89.9
2.0	0.25	60		17.4	4.7	94.6
3.0	0.125	120		15.2	4.1	98.7
PAN	<0.125			4.8	1.3	100.0
			total	366.9		

Comments: Lost 0.3g (0.1%) of sample in sieving.

SAMPLE LOG SHEET

Cedar Cr. (trowel; 28 ft. location)

1. Sample No. 3 2. Analyst MO 3. Date 5/12 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 204.7g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening Phi	mm	Mesh	Grade Size	Wt. Retained	Weight %	Cummulative %
-2.0	4.0	5		173.1	85.0	85.0
-1.0	2.0	10		11.0	5.4	90.4
0.0	1.0	18		7.2	3.5	93.9
1.0	0.50	35		8.2	4.0	97.9
2.0	0.25	60		2.3	1.1	99.0
3.0	0.125	120		1.4	0.7	99.7
PAN	<0.125			0.6	0.3	100.0
			total	203.8		

Comments: Lost 0.9g (0.4%) of sample in sieving.

SAMPLE LOG SHEET

Cedar Cr. (trowel; right bank looking upstream; approx. 5 ft. from water's edge)

1. Sample No. 4 2. Analyst MO 3. Date 5/12 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 424.4g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

	10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
	Phi	mm	Mesh				
*	-2.0	4.0	5		379.0	89.5	89.5
	-1.0	2.0	10		12.5	2.9	92.4
	0.0	1.0	18		12.2	2.9	95.3
	1.0	0.50	35		13.4	3.2	98.5
	2.0	0.25	60		2.9	0.7	99.2
	3.0	0.125	120		1.8	0.4	99.6
	PAN	<0.125			1.5	0.4	100.0
				total	423.3		

Comments: Lost 1.1g (0.3%) of sample in sieving.

* Includes several large rocks.

SAMPLE LOG SHEET

Hulls Cr. (trowel; right bank looking upstream; 5 ft. from water's edge; approx. 15 ft. above rd.)

1. Sample No. 1 2. Analyst MO 3. Date 3/3 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 350.4g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		208.9	63.6	63.6
-1.0	2.0	10		9.1	2.8	66.4
0.0	1.0	18		11.9	3.6	70.0
1.0	0.50	35		25.7	7.8	77.8
2.0	0.25	60		15.4	4.7	82.5
3.0	0.125	120		22.9	7.0	89.5
PAN	<0.125			34.3	10.5	100.0
			total	328.2		

Comments: Lost 2.2g (0.7%) of sample in sieving.

SAMPLE LOG SHEET

Hulls Cr. (trowel; right side of stream looking upriver; 5 ft. from water; approx. 15 ft. above road)

1. Sample No. 2 2. Analyst MO 3. Date 5/9 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 324.8 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-1.0	2.0	10		246.0	76.1	76.1
0.0	1.0	18		14.5	4.5	80.6
1.0	0.50	35		28.7	8.9	89.5
2.0	0.25	60		10.2	3.1	92.6
3.0	0.125	120		10.3	3.2	95.8
4.0	0.0625	230		4.4	1.4	97.2
PAN	<0.0625			9.0	2.8	100.0
			total	323.1		

Comments: Lost 1.7g (0.5%) of sample in sieving.

* Includes one large round rock approx. 7 cm x 5.5 cm x 4.5 cm weighing 237.3 g.

SAMPLE LOG SHEET

Hulls Cr. (trowel; left bank looking upstream; ≈ 5 ft. in water 20 ft. above rd.)

1. Sample No. 3 2. Analyst MO 3. Date 5/3 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; split on Seqor portasplitter; weighed on Sartorius balance to 0.1 g.; shaken mechanically for 15 min.)

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 165.1 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-1.0	2.0	10		6.4	3.9	3.9
0.0	1.0	18		23.1	14.1	18.0
1.0	0.50	35		89.1	54.5	72.5
2.0	0.25	60		27.1	16.6	89.1
3.0	0.125	120		12.2	7.4	96.5
4.0	0.0625	230		2.9	1.8	98.3
PAN	<0.0625			2.7	1.7	100.0
			total	163.5		

Comments: Lost 1.6g (1.0%) of sample in sieving.

SAMPLE LOG SHEET

Hulls Cr. (left bank looking upstream; approx 5 ft. from water's edge, 20 ft. upstream from road; trowell)

1. Sample No. 4 2. Analyst MO 3. Date 5/22 4. Summary of Preliminary Treatment, Dispersal, etc. Sample dried in oven overnight at 200°F, weighed on Sartorius balance to 0.1 g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 371.6 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 367.9 g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
1.0	0.50	35		36.6	10.0	10.0
1.5	0.35	45		20.6	5.6	15.6
2.0	0.25	60		62.4	17.0	32.6
2.5	0.177	80		100.0	27.3	59.9
3.0	0.125	120		88.8	24.3	84.2
3.5	0.088	170		21.2	5.8	90.0
PAN	<0.088			36.7	10.0	100.0
			total	366.3		

Comments: Lost 1.6g (0.4%) of sample in sieving.
Sample treated with 300 ml of 3% H_2O_2 and 300 ml distilled H_2O to remove organic matl.

SAMPLE LOG SHEET

Morrison Cr. (trowel; left bank 3 ft. from water's edge looking upstream)

1. Sample No. 1 2. Analyst MO 3. Date 5/9 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 270.5 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		155.8	58.0	58.0
-1.0	2.0	10		35.1	13.1	71.1
0.0	1.0	18		24.8	9.2	80.3
1.0	0.50	35		23.7	8.8	89.1
2.0	0.250	60		9.5	3.6	92.7
3.0	0.125	120		10.8	4.0	96.7
PAN	<0.125			9.0	3.3	100.0
			total	268.7		

Comments: Lost 1.8g (0.7%) of sample in sieving.

SAMPLE LOG SHEET

Morrison Cr. (cores; center of stream)

1. Sample No. 2 2. Analyst MO 3. Date 5/8 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 168.1 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		141.1	84.1	84.1
-1.0	2.0	10		19.0	11.3	95.4
0.0	1.0	18		5.8	3.4	98.8
1.0	0.50	35		1.3	0.8	99.6
2.0	0.25	60		0.1	0.1	99.7
3.0	0.125	120		0.1	0.1	99.8
PAN	<0.125			0.3	0.2	100.0
			total	167.7		

Comments: Lost 0.4g (0.2%) of sample in sieving.

SAMPLE LOG SHEET

Morrison Cr. (trowel; 3 ft. in stream from right bank looking upstream)

1. Sample No. 3 2. Analyst MO 3. Date 5/8 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 293.5 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		211.8	72.5	72.5
-1.0	2.0	10		25.7	8.8	81.3
0.0	1.0	18		18.3	6.3	87.6
1.0	0.50	35		22.5	7.7	95.3
2.0	0.25	60		6.5	2.2	97.5
3.0	0.125	120		4.3	1.5	99.0
PAN	<0.125			3.0	1.0	100.0
			total	292.1		

Comments: Lost 1.4g (0.5%) of sample in sieving.

SAMPLE LOG SHEET

Morrison Cr. (core; 3 ft. from water's edge; right bank looking upstream)

1. Sample No. 4 2. Analyst MO 3. Date 5/10 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 113.2 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-1.0	2.0	10		20.5	18.3	18.3
0.0	1.0	18		0.6	0.5	18.8
1.0	0.50	35		6.5	5.8	24.6
2.0	0.25	60		25.3	22.6	47.2
3.0	0.125	120		41.7	37.2	84.4
4.0	0.0625	230		11.4	10.2	94.6
PAN	<0.0625			6.1	5.4	100.0
			total	112.1		

Comments: Lost 1.1 g (1.0%) of sample in sieving.

SAMPLE LOG SHEET

Morrison Cr.

1. Sample No. 48 2. Analyst MO 3. Date 5/22 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 0.3g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 0.2g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				

Comments: Added 3 ml of 30% H_2O_2 to dissolve organic matl.

SAMPLE LOG SHEET

Nooning Cr. (trowel; 4 ft. from left bank looking upstream; bank matl.)

1. Sample No. 1 2. Analyst MO 3. Date 5/10 4. Summary of Preliminary Treatment, Dispersal, etc. Sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 182.4g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 182.0g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		132.2	72.9	72.9
-1.0	2.0	10		11.8	6.5	79.4
0.0	1.0	18		7.3	4.0	83.4
1.0	0.50	35		8.2	4.5	87.9
2.0	0.25	60		4.5	2.5	90.4
3.0	0.125	120		7.2	4.0	94.4
PAN	<0.125			10.2	5.6	100.0
			total	181.4		

Comments: Lost 0.6g (0.3%) of sample in sieving.
Sample treated with 100 ml distilled H_2O and 100 ml of 3% H_2O_2.

SAMPLE LOG SHEET

Nooning Cr. (trowel; 15 ft. location)

1. Sample No. 2 2. Analyst MO 3. Date 5/8 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 187.0 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		129.1	69.4	69.4
-1.0	2.0	10		23.3	12.5	81.9
0.0	1.0	18		12.9	6.9	88.8
1.0	0.50	35		10.9	5.9	94.7
2.0	0.25	60		3.2	1.7	96.4
3.0	0.125	120		3.9	2.1	98.5
PAN	<0.125			2.8	1.5	100.0
			total	186.1		

Comments: Lost 0.9 g (0.5%) of sample in sieving.

SAMPLE LOG SHEET

Nooning Cr. (trowel; bank matl. adjacent to stream; right bank looking upstream)

1. Sample No. 3 2. Analyst MO 3. Date 5/8 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 156.7g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

	10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
	Phi	mm	Mesh				
*	-2.0	4.0	5		109.0	70.2	70.2
	-1.0	2.0	10		11.5	7.4	77.6
	0.0	1.0	18		6.0	3.8	81.4
	1.0	0.50	35		7.4	4.8	86.2
	2.0	025	60		4.6	3.0	89.2
	3.0	0.125	120		8.2	5.3	94.5
	PAN	<0.125			8.6	5.5	100.0
				total	155.3		

Comments: Lost 1.4g (0.9%) of sample in sieving.

* Includes 1 large rock weighing 58.4g.

SAMPLE LOG SHEET

Scotts Cr. (trowel; approx. 6 ft. from left bank looking upstream)

1. Sample No. 1 2. Analyst MO 3. Date 5/18 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 213.7 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		60.9	28.5	28.5
-1.0	2.0	10		61.2	28.7	57.2
0.0	1.0	18		19.4	9.1	66.3
1.0	0.50	35		23.9	11.2	77.5
2.0	0.25	60		26.1	12.2	89.7
3.0	0.125	120		18.6	8.7	98.4
PAN	<0.125			3.3	1.6	100.0
			total	213.4		

Comments: Lost 0.3 g (0.1%) of sample in sieving.

SAMPLE LOG SHEET

Scotts Cr. (corer; 33 ft. location)

1. Sample No. 2 2. Analyst MO 3. Date 5/18 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 282.8 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		142.0	50.4	50.4
-1.0	2.0	10		33.7	11.9	62.3
0.0	1.0	18		24.1	8.5	70.8
1.0	0.50	35		55.7	19.8	90.6
2.0	0.25	60		19.1	6.8	97.4
3.0	0.125	120		4.6	1.6	99.0
PAN	<0.125			2.7	1.0	100.0
			total	281.9		

Comments: Lost 0.9g (0.3%) of sample in sieving.

SAMPLE LOG SHEET

Scotts Cr. (cores; near 10 ft. location)

1. Sample No. 3 2. Analyst MO 3. Date 5/19 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 81.9 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		33.9	41.5	41.5
-1.0	2.0	10		16.5	20.2	61.7
0.0	1.0	18		11.9	14.6	76.3
1.0	0.50	35		15.6	19.1	95.4
2.0	0.25	60		2.7	3.3	98.7
3.0	0.125	120		0.7	0.9	99.6
PAN	<0.125			0.3	0.4	100.0
			total	81.6		

Comments: Lost 0.3g (0.4%) of sample in sieving.

SAMPLE LOG SHEET

Scotts Cr. (trowel; approx. 6 ft. from right bank looking upstream)

1. Sample No. 4 2. Analyst MO 3. Date 5/8 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 282.9 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		215.9	76.5	76.5
-1.0	2.0	10		18.7	6.6	83.1
0.0	1.0	18		17.5	6.2	89.3
1.0	0.50	35		22.1	7.9	97.2
2.0	0.25	60		5.0	1.8	99.0
3.0	0.125	120		1.7	0.6	99.6
PAN	<0.125			1.2	0.4	100.0
			total	282.1		

Comments: Lost 0.8g (0.3%) of sample in sieving.

SAMPLE LOG SHEET

Scotts Cr.

1. Sample No. HS 2. Analyst MO 3. Date 5/22 4. Summary of Preliminary Treatment, Dispersal, etc. Sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 3.1 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 3.0g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				

Comments: Added 31 ml of 3% of H_2O_2 to dissolve organic matl.

SAMPLE LOG SHEET

Upper Stream Big Sulfur Cr.

1. Sample No.____ 2. Analyst____ 3. Date____ 4. Summary of Preliminary Treatment, Dispersal, etc.____

5. Dispersant added____; Concentration____; Vol.____

6. Weight of untreated sample____

7. Weight of sample after removal of carbonates, organic matter, iron oxides____

8. Pipette analysis; needed____; performed____

9. Settling tube; needed____; performed____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
	Stream dry during low flow survey; deleted from study.					

Comments:

REDDING DISTRICT

SAMPLE LOG SHEET

Brock Gulch (trowel; left bank looking upstream; 2 ft. from water's edge)

1. Sample No. 1 2. Analyst MO 3. Date 5/3 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 135.3 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 134.6g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		89.1	66.8	66.8
-1.0	2.0	10		11.0	8.2	75.0
0.0	1.0	18		5.3	4.0	79.0
1.0	0.50	35		5.3	4.0	88.0
2.0	0.25	60		2.3	1.7	84.7
3.0	0.125	120		4.7	3.5	88.2
PAN	<0.125			15.8	11.8	100.0
			total	133.5		

Comments: Lost 1.1g (0.8%) of sample in sieving.

Added 300 ml 3% H_2O_2 and 200 ml distilled H_2O to dissolve organic matl.

SAMPLE LOG SHEET

Brock Gulch (trowel; 3.6 ft. location)

1. Sample No. 2 2. Analyst MO 3. Date 5/2 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1 g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 121.2 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		57.0	47.6	47.6
-1.0	2.0	10		21.5	18.0	65.6
0.0	1.0	18		17.1	14.3	79.9
1.0	0.50	35		16.4	13.7	93.6
2.0	0.25	60		3.7	3.1	96.7
3.0	0.125	120		2.3	1.9	98.6
PAN	<0.125			1.7	1.4	100.0
			total	119.7		

Comments: Lost 1.5g (1.2%) of sample in sieving.

SAMPLE LOG SHEET

Brock Gulch (trowel; right bank; 2 ft. from water's edge looking upstream)

1. Sample No. 3 2. Analyst MO 3. Date 5/2 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1 g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 164.8 g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		118.6	72.8	72.8
-1.0	2.0	10		8.4	5.1	77.9
0.0	1.0	18		4.7	2.9	80.8
1.0	0.50	35		7.1	4.4	85.2
2.0	0.25	60		5.2	3.2	88.4
3.0	0.125	120		8.2	5.0	93.4
PAN	<0.125			10.7	6.6	100.0
			total	162.9		

Comments: Lost 1.9g (1.2%) of sample in sieving.

SAMPLE LOG SHEET

Buttle Forks (trowel; bank matl. approx. 1 ft. from water's edge; left bank looking upstream)

1. Sample No. 1 2. Analyst MO 3. Date 5/19 4. Summary of Preliminary Treatment, Dispersal, etc. Sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 242.1 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 240.1 g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		87.7	36.7	36.7
-1.0	2.0	10		21.7	9.1	45.8
0.0	1.0	18		18.4	7.7	53.5
1.0	0.50	35		25.7	10.8	64.3
2.0	025	60		14.6	6.1	70.4
3.0	0.125	120		30.2	12.6	83.0
PAN	<0.125			40.6	17.0	100.0
			total	238.9		

Comments: Lost 1.2g (0.5%) of sample in sieving.
Sample treated with 100 ml distilled H_2O and 100 ml of 3% H_2O_2 to dissolve organic matl.

SAMPLE LOG SHEET

Buffle Forks (trowel, 5.7 ft. location)

1. Sample No. 2 2. Analyst MO 3. Date 5/8 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 minutes

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 294.5g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
* -2.0	4.0	5		260.9	89.3	89.3
-1.0	2.0	10		10.0	3.4	92.7
0.0	1.0	18		7.4	2.6	95.3
1.0	0.50	35		7.3	2.5	97.8
2.0	0.25	60		2.1	0.7	98.5
3.0	0.125	120		2.1	0.7	99.2
PAN	<0.125			2.3	0.8	100.0
			total	292.1		

Comments: Lost 2.4g (0.8%) of sample in sieving.

* Includes 2 large rocks weighing 210.6 g.

SAMPLE LOG SHEET

Butte Forks (trowel; 7.1 ft. location)

1. Sample No. 3 2. Analyst MO 3. Date 5/3 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 194.4g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-1.0	2.0	10		72.1	37.4	37.4
0.0	1.0	18		42.1	21.8	59.2
1.0	0.50	35		33.8	17.5	76.7
2.0	0.25	60		12.8	6.7	83.4
3.0	0.125	120		15.2	7.9	91.3
4.0	0.0625	230		6.6	3.4	94.7
PAN	<0.0625			10.2	5.3	100.0
			total	192.8		

Comments: Lost 1.6g (0.8%) of sample in sieving.

SAMPLE LOG SHEET

Butte Forks (trowel; bank matl.; approx. 1 ft. from water's edge; right bank looking upstream)

1. Sample No. 4 2. Analyst MO 3. Date 5/19 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 256.3 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 250.3g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening Phi	mm	Mesh	Grade Size	Wt. Retained	Weight %	Cummulative %
-2.0	4.0	5		109.5	44.0	44.0
-1.0	2.0	10		39.6	15.9	59.9
0.0	1.0	18		24.9	10.0	69.9
1.0	0.50	35		32.3	13.0	82.9
2.0	0.25	60		14.4	5.8	88.7
3.0	0.125	120		13.6	5.4	94.1
PAN	<0.125			14.6	5.9	100.0
			total	248.9		

Comments: Lost 1.4g (0.6%) of sample in sieving.

Sample treated with 410 ml of 3% H_2O_2 to remove organic matl. and 200 ml distilled H_2O.

SAMPLE LOG SHEET

Butte Cr. Pwr. Stn.

1. Sample No.____ 2. Analyst____ 3. Date____ 4. Summary of Preliminary Treatment, Dispersal, etc.____

5. Dispersant added____; Concentration____; Vol.____

6. Weight of untreated sample____

7. Weight of sample after removal of carbonates, organic matter, iron oxides____

8. Pipette analysis; needed____; performed____

9. Settling tube; needed____; performed____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
	Material too rocky, water too deep to sample.					

Comments:

SAMPLE LOG SHEET

Indian Cr.

1. Sample No.____ 2. Analyst____ 3. Date____ 4. Summary of Preliminary Treatment, Dispersal, etc.____

5. Dispersant added____; Concentration____; Vol.____

6. Weight of untreated sample____

7. Weight of sample after removal of carbonates, organic matter, iron oxides____

8. Pipette analysis; needed____; performed____

9. Settling tube; needed____; performed____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
	Deleted from high flow study.					

Comments:

SAMPLE LOG SHEET

Sawpit Cr.

1. Sample No.____ 2. Analyst____ 3. Date____ 4. Summary of Preliminary Treatment, Dispersal, etc.____

5. Dispersant added____; Concentration____; Vol.____

6. Weight of untreated sample____

7. Weight of sample after removal of carbonates, organic matter, iron oxides____

8. Pipette analysis; needed____; performed____

9. Settling tube; needed____; performed____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
	Stream dry during low flow period; deleted from study.					

Comments:

SAMPLE LOG SHEET

Slide Cr.

1. Sample No.____ 2. Analyst____ 3. Date____ 4. Summary of Preliminary Treatment, Dispersal, etc.____

5. Dispersant added____; Concentration____; Vol.____

6. Weight of untreated sample____

7. Weight of sample after removal of carbonates, organic matter, iron oxides____

8. Pipette analysis; needed____; performed____

9. Settling tube; needed____; performed____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
	Stream dry during low flow period; deleted from study.					

Comments:

SAMPLE LOG SHEET

Willow Cr. tributary (trowel; bank matl.; approx. 1 ft. from water's edge; left bank looking upstream)

1. Sample No. 1 2. Analyst MO 3. Date 5/3 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1 g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 35.1 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 34.5g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
1.0	0.50	35		9.6	28.7	28.7
1.5	0.35	45		2.1	6.3	35.0
2.0	0.25	60		4.7	14.1	49.1
2.5	0.177	80		5.0	15.0	64.1
3.0	0.125	120		4.8	14.4	78.5
3.5	0.088	170		2.3	6.9	85.4
PAN	<0.088			4.9	14.6	100.0
			total	33.4		

Comments: Lost 1.1g (3.2%) of sample in sieving. Sample treated with 400 ml of 3% H_2O_2 and 200 ml of distilled H_2O to dissolve organic matl.

SAMPLE LOG SHEET

Willow Cr. tributary (trowel; 2.2 ft. location midstream)

1. Sample No. 2 2. Analyst MO 3. Date 5/2 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 112.7g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		59.4	53.3	53.3
-1.0	2.0	10		19.1	17.2	70.5
0.0	1.0	18		15.7	14.1	84.6
1.0	0.50	35		13.4	12.0	96.6
2.0	0.25	60		2.7	2.4	99.0
3.0	0.125	120		0.8	0.7	99.7
PAN	<0.125			0.3	0.3	100.0
			total	111.4		

Comments: Lost 1.3g (1.2%) of sample in sieving.

SAMPLE LOG SHEET

Willow Cr. tributary (approx. 1 ft. from water's edge; right bank looking upstream; trowel)

1. Sample No. 3 2. Analyst MO 3. Date 5/3 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 887 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 87.7g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening Phi	mm	Mesh	Grade Size	Wt. Retained	Weight %	Cummulative %
* 1.0	0.50	35		42.5	49.4	49.4
1.5	0.35	45		2.3	2.7	52.1
2.0	0.25	60		4.6	5.3	57.4
2.5	0.177	80		7.3	8.5	65.9
3.0	0.125	120		11.5	13.4	79.3
3.5	0.088	170		5.3	6.1	85.4
PAN	<0.088			12.6	14.6	100.0
			total	86.1		

Comments: Lost 1.6g (1.8%) of sample in sieving. Sample treated with 400 ml of 3% H_2O_2 and 200 ml distilled H_2O to dissolve organic matl.

* Contains one rock weighing 25.5g.

SUSANVILLE DISTRICT

SAMPLE LOG SHEET

Badger Cr. (bank matl.; approx. 1½ ft. from water's edge; left bank looking upstream; travel)

1. Sample No. 1 2. Analyst MO 3. Date 4/27 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; split on Sepor portasplitter & weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 258.4g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
1.5	0.35	45		4.7	1.8	1.8
2.0	0.25	60		11.2	4.4	6.2
2.5	0.177	80		101.1	39.7	45.9
3.0	0.125	120		82.3	32.3	78.2
3.5	0.088	170		25.4	10.0	88.2
4.0	0.0625	230		15.2	6.0	94.2
PAN	<0.0625			14.9	5.8	100.0
			total	254.8		

Comments: Lost 3.6g (1.4%) of sample in sieving.

SAMPLE LOG SHEET

Badger Cr. (17 ft. location; trowel)

1. Sample No. 2 2. Analyst MO 3. Date 4/26 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g and shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 248.4g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		11.7	4.7	4.7
-1.0	2.0	10		38.8	15.7	20.4
0.0	1.0	18		78.8	32.0	52.4
1.0	0.50	35		87.8	35.6	88.0
2.0	0.25	60		14.7	6.0	94.0
3.0	0.125	120		7.1	2.9	96.9
PAN	<0.125			7.6	3.1	100.0
			total	246.5		

Comments: Lost 1.9g (0.8%) of sample in sieving.

SAMPLE LOG SHEET

Badger Cr. (10.0 ft. location; trowel)

1. Sample No. 3 2. Analyst MO 3. Date 4/27 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g and shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 264.5g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening Phi	mm	Mesh	Grade Size	Wt. Retained	Weight %	Cummulative %
-2.0	4.0	5		38.9	14.8	14.8
-1.0	2.0	10		76.0	29.0	43.8
0.0	1.0	18		68.5	26.1	69.9
1.0	0.50	35		43.1	16.4	86.3
2.0	0.25	60		16.5	6.3	92.6
3.0	0.125	120		14.9	5.7	98.3
PAN	<0.125			4.4	1.7	100.0
			total	262.3		

Comments: Lost 2.2g (0.8%) of sample in sieving.

SAMPLE LOG SHEET

Bare Cr. (trowel; 6.6 ft. location)

1. Sample No. 2 2. Analyst MO 3. Date 5/17 4. Summary of Preliminary Treatment, Dispersal, etc. Sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 124.4g

7. Weight of sample after removal of carbonates, organic matter, iron oxides 122.8g

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-1.0	2.0	10		3.9	3.2	3.2
0.0	1.0	18		10.4	8.5	11.7
1.0	0.50	35		28.3	23.2	34.9
2.0	0.25	60		18.4	15.1	50.0
3.0	0.125	120		34.4	28.3	78.3
4.0	0.0625	230		15.4	12.7	91.0
PAN	<0.0625			10.9	9.0	100.0
			total	121.7		

Comments: Lost 1.1g (0.9%) of sample in sieving.
Sample treated with 100 ml distilled H_2O and 100 ml of 3% H_2O_2 to dissolve organic matl.

SAMPLE LOG SHEET

Bare Cr. (trowel; left bank looking upstream approx. 1 ft. from water's edge)

1. Sample No. 3 2. Analyst MO 3. Date 5/19 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 261.9 g

7. Weight of sample after removal of carbonates, organic matter, iron oxides 259.5g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-1.0	2.0	10		89.3	34.6	34.6
0.0	1.0	18		9.6	3.7	38.3
1.0	0.50	35		24.7	9.6	47.9
2.0	0.25	60		22.6	8.8	56.7
3.0	0.125	120		64.8	25.1	81.8
4.0	0.0625	230		25.1	9.7	91.5
PAN	<0.0625			22.0	8.5	100.0
			total	258.1		

Comments: Lost 1.4g (0.5%) of sample in sieving.
Sample treated with 100ml distilled H_2O and 100 ml of 3% H_2O_2 to dissolve organic matl.

SAMPLE LOG SHEET

Bare Cr.

1. Sample No. HS 2. Analyst MO 3. Date 5/23 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 9.0g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 8.7g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				

Comments: Added 90 ml. of 3% H_2O_2 to dissolve organic matt.

SAMPLE LOG SHEET

High Rock Cr.

1. Sample No.____ 2. Analyst____ 3. Date____ 4. Summary of Preliminary Treatment, Dispersal, etc.____

5. Dispersant added____; Concentration____; Vol.____

6. Weight of untreated sample____

7. Weight of sample after removal of carbonates, organic matter, iron oxides____

8. Pipette analysis; needed____; performed____

9. Settling tube; needed____; performed____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
	Deleted from high flow survey due to difficulties					
		in accessibility.				

Comments:

SAMPLE LOG SHEET

Lost Cr. (trowel; approx. 3 ft. from water's edge; right bank matl. looking upstream)

1. Sample No. 1 2. Analyst MO 3. Date 5/3 4. Summary of Preliminary Treatment, Dispersal, etc. Sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 227.4g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 223.2g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
* 1.0	0.50	35		16.9	7.7	7.7
1.5	035	45		3.2	1.4	9.1
2.0	025	60		6.7	3.1	12.2
2.5	0.177	80		27.8	12.7	24.9
3.0	0.125	120		86.4	39.4	64.3
3.5	0.088	170		27.4	12.5	76.8
PAN	<0.088			50.8	23.2	100.0
			total	219.2		

Comments: Lost 4.0g (1.8%) of sample in sieving.

Sample treated with 300 ml 3% H_2O_2 and 300 ml distilled H_2O to dissolve organic matl.

*Sample includes one rock weighing 4.0g.

SAMPLE LOG SHEET

Lost Cr. (trowel; 4 ft. location)

1. Sample No. 2 2. Analyst MO 3. Date 5/2 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 231.0 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		165.7	72.3	72.3
-1.0	2.0	10		16.8	7.3	79.6
0.0	1.0	18		12.6	5.5	85.1
1.0	0.50	35		20.0	8.7	93.8
2.0	0.25	60		7.9	3.5	97.3
3.0	0.125	120		4.5	2.0	99.3
PAN	<0.125			1.6	0.7	100.0
			total	229.1		

Comments: Lost 1.9g (0.8%) of sample in sieving.

SAMPLE LOG SHEET

Lost Cr. (trowel; 6 ft. location)

1. Sample No. 3 2. Analyst MO 3. Date 4/27 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 287.1 g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		176.8	61.9	61.9
-1.0	2.0	10		30.5	10.7	72.6
0.0	1.0	18		25.7	9.0	81.6
1.0	0.50	35		35.7	12.5	94.1
2.0	0.25	60		9.2	3.2	97.3
3.0	0.125	120		4.8	1.7	99.0
PAN	<0.125			2.8	1.0	100.0
			total	285.5		

Comments: Lost 1.6g (0.6%) of sample in sieving.

SAMPLE LOG SHEET

Lost Cr. (trowel; bank matl; approx. 3 ft. from water's edge; left bank looking upstream)

1. Sample No. 4 2. Analyst MO 3. Date 4/27 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; split on Sepor portasplitter and weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 131.3g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
0.5	0.71	25		38.2	29.6	29.6
1.0	0.50	35		15.0	11.6	41.2
1.5	0.35	45		5.5	4.3	45.5
2.0	0.25	60		9.5	7.4	52.9
2.5	0.177	80		13.1	10.2	63.1
3.0	0.125	120		16.7	13.0	76.1
PAN	<0.125			30.8	23.9	100.0
			total	128.8		

Comments: Lost 2.5g (1.9%) of sample in sieving.

SAMPLE LOG SHEET

Lost Cr.

1. Sample No. H5 2. Analyst MO 3. Date 5/23 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200F; weighed on Sartorius balance to 0.1g

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 39.1g

7. Weight of sample after removal of carbonates, organic matter, iron oxides 38.9g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				

Comments: Added 100 ml of 3% H_2O_2 to dissolve organic matl.

SAMPLE LOG SHEET

Wall Cr. (travel; bank matl; 1 ft. from water's edge; right bank looking upstream)

1. Sample No. 1 2. Analyst MO 3. Date 5/11 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; split on Seprportasplitter & weighed on Sartorius balance to 0.1g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 170.2g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
1.5	0.35	45		52.6	31.3	31.3
2.0	0.25	60		12.3	7.3	38.6
2.5	0.177	80		13.7	8.1	46.7
3.0	0.125	120		26.7	15.9	62.6
3.5	0.088	170		10.8	6.4	69.0
4.0	0.0625	230		12.9	7.7	76.7
PAN	<0.0625			39.1	23.3	100.0
			total	168.1		

Comments: Lost 2.1g (1.2%) of sample in sieving.

SAMPLE LOG SHEET

Wall Cr. (trowel; 4-1 ft. location)

1. Sample No. 2 2. Analyst MO 3. Date 5/11 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; split on jonasplitter; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 140.7 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
1.5	0.35	45		55.8	40.5	40.5
2.0	0.25	60		12.2	8.9	49.4
2.5	0.177	80		11.7	8.5	57.9
3.0	0.125	120		32.8	23.8	81.7
3.5	0.088	170		4.2	3.0	84.7
4.0	0.0625	230		6.6	4.8	89.5
PAN	<0.0625			14.5	10.5	100.0
			total	137.8		

Comments: Lost 2.9g (2.1%) of sample in sieving.

SAMPLE LOG SHEET

Wall Cr. (trowel; 14.1 ft. location)

1. Sample No. 3 2. Analyst MO 3. Date 5/3 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 205.0 g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		125.8	61.8	61.8
-1.0	2.0	10		16.6	8.2	70.0
0.0	1.0	18		16.7	8.2	78.2
1.0	0.50	35		23.7	11.6	89.8
2.0	0.25	60		7.9	3.9	93.7
3.0	0.125	120		6.3	3.1	96.8
PAN	<0.125			6.5	3.2	100.0
			total	203.5		

Comments: Lost 1.5g (0.7%) of sample in sieving.

Obsidian in sample.

SAMPLE LOG SHEET

Wall Cr. (trowel; left bank looking upstream; approx. 4 ft. from water's edge)

1. Sample No. 4 2. Analyst MO 3. Date 5/10 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 214.1 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
1.5	0.35	45		25.4	12.0	12.0
2.0	0.25	60		27.2	12.8	24.8
2.5	0.177	80		37.6	17.7	42.5
3.0	0.125	120		41.3	19.5	62.0
3.5	0.088	170		13.2	6.2	68.2
4.0	0.0625	230		18.1	8.6	76.8
PAN	<0.0625			49.2	23.2	100.0
			total	212.0		

Comments: Lost 2.1g (1.0%) of sample in sieving.

SAMPLE LOG SHEET

Wall Canyon Cr. (corer; bank matl.; approx. 2 ft. from right bank looking upstream)

1. Sample No. 1 2. Analyst MO 3. Date 5/10 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 146.3g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-1.0	2.0	10		2.3	1.6	1.6
0.0	1.0	18		10.7	7.4	9.0
1.0	0.50	35		46.3	31.9	40.9
2.0	0.25	60		26.9	18.5	59.4
3.0	0.125	120		36.2	25.0	84.4
4.0	0.0625	230		10.5	7.2	91.6
PAN	<.0625			12.2	8.4	100.0
			total	145.1		

Comments: Lost 1.2g (0.8%) of sample lost in sieving.

SAMPLE LOG SHEET

Wall Canyon Cr. (8.2 ft. location; corer)

1. Sample No. 2 2. Analyst MO 3. Date 5/2 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 215.5g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		30.1	14.1	14.1
-1.0	2.0	10		41.0	19.1	33.2
0.0	1.0	18		49.6	23.2	56.4
1.0	0.50	35		66.6	31.1	87.5
2.0	0.25	60		17.0	7.9	95.4
3.0	0.125	120		5.8	2.7	98.1
PAN	<0.125			4.1	1.9	100.0
			total	214.2		

Comments: Lost 1.3g (0.6%) of sample in sieving.

SAMPLE LOG SHEET

Wall Canyon Cr. (core; 10.2 ft. location)

1. Sample No. 3 2. Analyst MO 3. Date 5/9 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 211.9 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-1.0	2.0	10		24.1	11.5	11.5
0.0	1.0	18		26.7	12.7	24.2
1.0	0.50	35		79.4	37.8	62.0
2.0	0.25	60		40.0	19.0	81.0
3.0	0.125	120		22.8	10.8	91.8
4.0	0.0625	230		7.0	3.3	95.1
PAN	<0.0625			10.3	4.9	100.0
			total	210.3		

Comments: Lost 1.6g (0.8%) of sample in sieving.

SAMPLE LOG SHEET

Wall Canyon Cr. (trowel; bank matl.; ≈ 2 ft. from left bank looking upstream)

1. Sample No. 4 2. Analyst MO 3. Date 4/27 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 269.5 g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-1.5	2.83	7		17.5	6.5	6.5
-1.0	2.00	10		13.4	5.0	11.5
-0.5	1.41	14		21.9	8.2	19.7
0.0	1.00	18		32.3	12.1	31.8
0.5	0.71	25		45.9	17.1	48.9
1.0	0.50	35		59.3	22.1	71.0
PAN	<0.50			77.8	29.0	100.0
			total	268.1		

Comments: Lost 1.4g (0.5%) of sample in sieving.

SAMPLE LOG SHEET

Wall Canyon Cr.

1. Sample No. HS 2. Analyst MO 3. Date 5/25 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g.

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 2.3g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 2.2g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				

Comments: Added 23 ml of 3% of H_2O_2 to dissolve organic matl.

SAMPLE LOG SHEET

Badger Cr.

1. Sample No. HS 2. Analyst MO 3. Date 5/22 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; weighed on Sartorius balance to 0.1g

5. Dispersant added _____; Concentration ____; Vol. _____

6. Weight of untreated sample 27.3g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides 27.1g.

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				

Comments: Added 170 ml of 3% H_2O_2 to dissolve organic matl.

SAMPLE LOG SHEET

Bare Cr. (trowel; right bank looking upstream approx. 3 ft. from water's edge)

1. Sample No. 1 2. Analyst MO 3. Date 5/9 4. Summary of Preliminary Treatment, Dispersal, etc. Sample dried in oven overnight at 200°F; weighed on Sartorius balance to 0.1 g; sieved mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 302.6 g.

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
-2.0	4.0	5		167.3	55.6	55.6
-1.0	2.0	10		32.6	10.8	66.4
0.0	1.0	18		21.8	7.2	73.6
1.0	0.50	35		30.2	10.0	83.6
2.0	0.25	60		16.4	5.5	89.1
3.0	0.125	120		18.8	6.2	95.3
PAN	<0.125			14.1	4.7	100.0
			total	301.2		

Comments: Lost 1.4g (0.5%) of sample in sieving.

SAMPLE LOG SHEET

Badger Cr. (trowel; bank matl.; approx. 2 ft. from water's edge; right bank looking upstream)

1. Sample No. 4 2. Analyst MO 3. Date 5/11 4. Summary of Preliminary Treatment, Dispersal, etc. sample dried overnight in oven at 200°F; split on Seporter splitter & weighed on Sartorius balance to 0.1 g; shaken mechanically for 15 min.

5. Dispersant added _____; Concentration _____; Vol. _____

6. Weight of untreated sample 174.3 g

7. Weight of sample after removal of carbonates, organic matter, iron oxides _____

8. Pipette analysis; needed _____; performed _____

9. Settling tube; needed _____; performed _____

10. Sieve Opening			Grade Size	Wt. Retained	Weight %	Cummulative %
Phi	mm	Mesh				
1.5	0.35	45		9.3	5.4	5.4
2.0	0.25	60		8.0	4.6	10.0
2.5	0.177	80		17.2	10.0	20.0
3.0	0.125	120		52.3	30.4	50.4
3.5	0.088	170		16.6	9.6	60.0
4.0	0.0625	230		22.7	13.2	73.2
PAN	<0.0625			46.1	26.8	100.0
			total	172.2		

Comments: Lost 2.1 g (1.2%) of sample in sieving.

Obsidian in sample.

APPENDIX F

FEDERAL WATER QUALITY REGULATIONS

ENVIRONMENTAL PROTECTION AGENCY NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS

(40 CFR 141; 40 FR 59565, December 24, 1975; Amended by 41 FR 28402, July 9, 1976)

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER D—WATER PROGRAMS

PART 141—NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS

Subpart A—General

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141.2 Definitions.
141.3 Coverage.
141.4 Variances and exemptions.
141.5 Siting requirements.
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Subpart B—Maximum Contaminant Levels

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141.12 Maximum contaminant levels for organic chemicals.
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Sec.
141.22 Turbidity sampling and analytical requirements.
141.23 Inorganic chemical sampling and analytical requirements.
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141.27 Alternative analytical techniques.
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141.32 Public notification of variances, exemptions, and non-compliance with regulations.
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Subpart E — Special Monitoring Regulations for Organic Chemicals

AUTHORITY: Secs. 1412, 1414, 1445, and 1450 of the Public Health Service Act, 88 Stat. 1660 (42 U.S.C. 300g–1, 300g–3, 300j–4, and 300j–9).

Subpart A—General

§ 141.1 Applicability.

This part establishes primary drinking water regulations pursuant to section 1412 of the Public Health Service Act, as amended by the Safe Drinking Water Act (Pub. L. 93–523); and related regulations applicable to public water systems.

§ 141.2 Definitions.

As used in this part, the term:

(a) "Act" means the Public Health Service Act, as amended by the Safe Drinking Water Act, Pub. L. 93–523.

(b) "Contaminant" means any physical, chemical, biological, or radiological substance or matter in water.

(c) "Maximum contaminant level" means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system, except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition.

(d) "Person" means an individual, corporation, company, association, partnership, State, municipality, or Federal agency.

(e) "Public water system" means a system for the provision to the public of piped water for human consumption, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year. Such term includes (1) any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system, and (2) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. A public water system is either a "community water system" or a "non-community water system."

(i) "Community water system" means a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

(ii) "Non-community water system" means a public water system that is not a community water system.

(f) "Sanitary survey" means an on-site review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation and maintenance for producing and distributing safe drinking water.

(g) "Standard sample" means the aliquot of finished drinking water that is examined for the presence of coliform bacteria.

(h) "State" means the agency of the State government which has jurisdiction over public water systems. During any period when a State does not have primary enforcement responsibility pursuant to Section 1413 of the Act, the term "State" means the Regional Administrator, U.S. Environmental Protection Agency.

(i) "Supplier of water" means any person who owns or operates a public water system.

(j) "Dose equivalent" means the product of the absorbed dose from ionizing radiation and such factors as account for differences in biological effectiveness due to the type of radiation and its distribution in the body as specified by the International Commission on Radiological Units and Measurements (ICRU).

(k) "Rem" means the unit of dose equivalent from ionizing radiation to the total body or any internal organ or organ system. A "millirem (mrem)" is 1/1000 of a rem.

(l) "Picocurie (pCi)" means that quantity of radioactive material producing 2.22 nuclear transformations per minute.

(m) "Gross alpha particle activity" means the total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

(n) "Man-made beta particle and photon emitters" means all radionuclides emitting beta particles and/or photons listed in Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure, NBS Handbook 69, except the daughter products of thorium–232, uranium–235 and uranium–238.

(o) "Gross beta particle activity" means the total radioactivity due to beta particle emission as inferred from measurements on a dry sample.

[41 FR 28402, July 9, 1976]

§ 141.3 Coverage.

This part shall apply to each public water system, unless the public water system meets all of the following conditions:

(a) Consists only of distribution and storage facilities (and does not have any collection and treatment facilities);

(b) Obtains all of its water from, but is not owned or operated by, a public water system to which such regulations apply;

(c) Does not sell water to any person; and

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(d) Is not a carrier which conveys passengers in interstate commerce.

§ 141.4 Variances and exemptions.

Variances or exemptions from certain provisions of these regulations may be granted pursuant to Sections 1415 and 1416 of the Act by the entity with primary enforcement responsibility. Provisions under Part 142, *National Interim Primary Drinking Water Regulations Implementation*—subpart E (Variances) and subpart F (Exemptions)—apply where EPA has primary enforcement responsibility.

§ 141.5 Siting requirements.

Before a person may enter into a financial commitment for or initiate construction of a new public water system or increase the capacity of an existing public water system, he shall notify the State and, to the extent practicable, avoid locating part or all of the new or expanded facility at a site which:

(a) Is subject to a significant risk from earthquakes, floods, fires or other disasters which could cause a breakdown of the public water system or a portion thereof; or

(b) Except for intake structures, is within the floodplain of a 100-year flood or is lower than any recorded high tide where appropriate records exist.

The U.S. Environmental Protection Agency will not seek to override land use decisions affecting public water systems siting which are made at the State or local government levels.

§ 141.6 Effective date.

The regulations set forth in this part shall take effect 18 months after the date of promulgation.

Subpart B—Maximum Contaminant Levels

§ 141.11 Maximum contaminant levels for inorganic chemicals.

(a) The maximum contaminant level for nitrate is applicable to both community water systems and non-community water systems. The levels for the other inorganic chemicals apply only to community water systems. Compliance with maximum contaminant levels for inorganic chemicals is calculated pursuant to § 141.23.

(b) The following are the maximum contaminant levels for inorganic chemicals other than fluoride:

Contaminant	*Level, milligrams per liter*
Arsenic	0.05
Barium	1.
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10.
Selenium	0.01
Silver	0.05

(c) When the annual average of the maximum daily air temperatures for the location in which the community water system is situated is the following, the maximum contaminant levels for fluoride are:

Temperature Degrees Fahrenheit	Degrees Celsius	Level, milligrams per liter
53.7 and below	12.0 and below	2.4
53.8 to 58.3	12.1 to 14.6	2.2
58.4 to 63.8	14.7 to 17.6	2.0
63.9 to 70.6	17.7 to 21.4	1.8
70.7 to 79.2	21.5 to 26.2	1.6
79.3 to 90.5	26.3 to 32.5	1.4

§ 141.12 Maximum contaminant levels for organic chemicals.

The following are the maximum contaminant levels for organic chemicals. They apply only to community water systems. Compliance with maximum contaminant levels for organic chemicals is calculated pursuant to § 141.24.

	Level, milligrams per liter
(a) Chlorinated hydrocarbons:	
Endrin (1,2,3,4,10, 10-hexachloro-6,7-epoxy-1,4, 4a,5,6,7,8,8a-octahydro-1,4-endo, endo-5,8 - dimethano naphthalene).	0.0002
Lindane (1,2,3,4,5,6-hexachlorocyclohexane, gamma isomer).	0.004
Methoxychlor (1,1,1-Trichloro-2, 2 - bis [p-methoxyphenyl] ethane).	0.1
Toxaphene ($C_{10}H_{10}Cl_8$-Technical chlorinated camphene, 67–69 percent chlorine).	0.005
(b) Chlorophenoxys:	
2,4 - D, (2,4-Dichlorophenoxyacetic acid).	0.1
2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid).	0.01

§ 141.13 Maximum contaminant levels for turbidity.

The maximum contaminant levels for turbidity are applicable to both community water systems and non-community water systems using surface water sources in whole or in part. The maximum contaminant levels for turbidity in drinking water, measured at a representative entry point(s) to the distribution system, are:

(a) One turbidity unit (TU), as determined by a monthly average pursuant to § 141.22, except that five or fewer turbidity units may be allowed if the supplier of water can demonstrate to the State that the higher turbidity does not do any of the following:

(1) Interfere with disinfection;

(2) Prevent maintenance of an effective disinfectant agent throughout the distribution system; or

(3) Interfere with microbiological determinations.

(b) Five turbidity units based on an average for two consecutive days pursuant to § 141.22.

§ 141.14 Maximum microbiological contaminant levels.

The maximum contaminant levels for coliform bacteria, applicable to community water systems and non-community water systems, are as follows:

(a) When the membrane filter technique pursuant to § 141.21(a) is used, the number of coliform bacteria shall not exceed any of the following:

(1) One per 100 milliliters as the arithmetic mean of all samples examined per month pursuant to § 141.21 (b) or (c);

(2) Four per 100 milliliters in more than one sample when less than 20 are examined per month; or

(3) Four per 100 milliliters in more than five percent of the samples when 20 or more are examined per month.

(b) (1) When the fermentation tube method and 10 milliliter standard portions pursuant to § 141.21(a) are used, coliform bacteria shall not be present in any of the following:

(i) more than 10 percent of the portions in any month pursuant to § 141.21 (b) or (c);

(ii) three or more portions in more than one sample when less than 20 samples are examined per month; or

(iii) three or more portions in more than five percent of the samples when 20 or more samples are examined per month.

(2) When the fermentation tube method and 100 milliliter standard portions pursuant to § 141.21(a) are used, coliform bacteria shall not be present in any of the following:

(i) more than 60 percent of the portions in any month pursuant to § 141.21 (b) or (c);

(ii) five portions in more than one sample when less than five samples are examined per month; or

(iii) five portions in more than 20 percent of the samples when five or more samples are examined per month.

(c) For community or non-community systems that are required to sample at a rate of less than 4 per month, compliance with paragraphs (a), (b)(1), or (b)(2) of this section shall be based upon sampling during a 3 month period, except that, at the discretion of the State, compliance may be based upon sampling during a one-month period.

§ 141.15 Maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity in community water systems.

[41 FR 28402, July 9, 1976]

The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity:

(a) Combined radium-226 and radium-228—5 pCi/1.

(b) Gross alpha particle activity (including radium-226 but excluding radon and uranium)—15 pCi/1.

§ 141.16 Maximum contaminant levels for beta particle and photon radioactivity from man-made radionuclides in community water systems.

[41 FR 28402, July 9, 1976]

(a) The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year.

(b) Except for the radionuclides listed in Table A, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be

calculated on the basis of a 2 liter per day drinking water intake using the 168 hour data listed in "*Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure,*" NBS Handbook 69 as amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 millirem/year.

TABLE A.—*Average annual concentrations assumed to produce a total body or organ dose of 4 mrem/yr*

Radionuclide	Critical organ	pCi per liter
Tritium	Total body	20,000
Strontium-90	Bone marrow	8

Subpart C—Monitoring and Analytical Requirements

§ 141.21 Microbiological contaminant sampling and analytical requirements.

(a) Suppliers of water for community water systems and non-community water systems shall analyze for coliform bacteria for the purpose of determining compliance with § 141.14. Analyses shall be conducted in accordance with the analytical recommendations set forth in "Standard Methods for the Examination of Water and Wastewater," American Public Health Association, 13th Edition, pp. 662–688, except that a standard sample size shall be employed. The standard sample used in the membrane filter procedure shall be 100 milliliters. The standard sample used in the 5 tube most probable number (MPN) procedure (fermentation tube method) shall be 5 times the standard portion. The standard portion is either 10 milliliters or 100 milliliters as described in § 141.14 (b) and (c). The samples shall be taken at points which are representative of the conditions within the distribution system.

(b) The supplier of water for a community water system shall take coliform density samples at regular time intervals, and in number proportionate to the population served by the system. In no event shall the frequency be less than as set forth below:

Population served:	*Minimum number of samples per month*
25 to 1,000	1
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4
4,101 to 4,900	5
4,901 to 5,800	6
5,801 to 6,700	7
6,701 to 7,600	8
7,601 to 8,500	9
8,501 to 9,400	10
9,401 to 10,300	11
10,301 to 11,100	12
11,101 to 12,000	13
12,001 to 12,900	14
12,901 to 13,700	15
13,701 to 14,600	16
14,601 to 15,500	17
15,501 to 16,300	18
16,301 to 17,200	19
17,201 to 18,100	20
18,101 to 18,900	21
18,901 to 19,800	22
19,801 to 20,700	23
20,701 to 21,500	24
21,501 to 22,300	25
22,301 to 23,200	26
23,201 to 24,000	27
24,001 to 24,900	28
24,901 to 25,000	29
25,001 to 28,000	30
28,001 to 33,000	35
33,001 to 37,000	40
37,001 to 41,000	45
41,001 to 46,000	50
46,001 to 50,000	55
50,001 to 54,000	60
54,001 to 59,000	65
59,001 to 64,000	70
64,001 to 70,000	75
70,001 to 76,000	80
76,001 to 83,000	85
83,001 to 90,000	90
90,001 to 96,000	95
96,001 to 111,000	100
111,001 to 130,000	110
130,001 to 160,000	120
160,001 to 190,000	130
190,001 to 220,000	140
220,001 to 250,000	150
250,001 to 290,000	160
290,001 to 320,000	170
320,001 to 360,000	180
360,001 to 410,000	190
410,001 to 450,000	200
450,001 to 500,000	210
500,001 to 550,000	220
550,001 to 600,000	230
600,001 to 660,000	240
660,001 to 720,000	250
720,001 to 780,000	260
780,001 to 840,000	270
840,001 to 910,000	280
910,001 to 970,000	290
970,001 to 1,050,000	300
1,050,001 to 1,140,000	310
1,140,001 to 1,230,000	320
1,230,001 to 1,320,000	330
1,320,001 to 1,420,000	340
1,420,001 to 1,520,000	350
1,520,001 to 1,630,000	360
1,630,001 to 1,730,000	370
1,730,001 to 1,850,000	380
1,850,001 to 1,970,000	390
1,970,001 to 2,060,000	400
2,060,001 to 2,270,000	410
2,270,001 to 2,510,000	420
2,510,001 to 2,750,000	430
2,750,001 to 3,020,000	440
3,020,001 to 3,320,000	450
3,320,001 to 3,620,000	460
3,620,001 to 3,960,000	470
3,960,001 to 4,310,000	480
4,310,001 to 4,690,000	490
4,690,001 or more	500

Based on a history of no coliform bacterial contamination and on a sanitary survey by the State showing the water system to be supplied solely by a protected ground water source and free of sanitary defects, a community water system serving 25 to 1,000 persons, with written permission from the State, may reduce this sampling frequency except that in no case shall it be reduced to less than one per quarter.

(c) The supplier of water for a non-community water system shall sample for coliform bacteria in each calendar quarter during which the system provides water to the public. Such sampling shall begin within two years after the effective date of this part. If the State, on the basis of a sanitary survey, determines that some other frequency is more appropriate, that frequency shall be the frequency required under these regulations. Such frequency shall be confirmed or changed on the basis of subsequent surveys.

(d) (1) When the coliform bacteria in a single sample exceed four per 100 milliliters (§ 141.14(a)), at least two consecutive daily check samples shall be collected and examined from the same sampling point. Additional check samples shall be collected daily, or at a frequency established by the State, until the results obtained from at least two consecutive check samples show less than one coliform bacterium per 100 milliliters.

(2) When coliform bacteria occur in three or more 10 ml portions of a single sample (§ 141.14(b)(1)), at least two consecutive daily check samples shall be collected and examined from the same sampling point. Additional check samples shall be collected daily, or at a frequency established by the State, until the results obtained from at least two consecutive check samples show no positive tubes.

(3) When coliform bacteria occur in all five of the 100 ml portions of a single sample (§ 141.14(b)(2)), at least two daily check samples shall be collected and examined from the same sampling point. Additional check samples shall be collected daily, or at a frequency established by the State, until the results obtained from at least two consecutive check samples show no positive tubes.

(4) The location at which the check samples were taken pursuant to paragraphs (d) (1), (2), or (3) of this section shall not be eliminated from future sampling without approval of the State. The results from all coliform bacterial analyses performed pursuant to this subpart, except those obtained from check samples and special purpose samples, shall be used to determine compliance with the maximum contaminant level for coliform bacteria as established in § 141.14. Check samples shall not be included in calculating the total number of samples taken each month to determine compliance with § 141.21 (b) or (c).

(e) When the presence of coliform bacteria in water taken from a particular sampling point has been confirmed by any check samples examined as directed in paragraphs (d) (1), (2), or (3) of this section, the supplier of water shall report to the State within 48 hours.

(f) When a maximum contaminant level set forth in paragraphs (a), (b) or (c) of § 141.14 is exceeded, the supplier of water shall report to the State and notify the public as prescribed in § 141.31 and § 141.32.

(g) Special purpose samples, such as those taken to determine whether disinfection practices following pipe placement, replacement, or repair have been sufficient, shall not be used to determine compliance with § 141.14 or § 141.21 (b) or (c).

(h) A supplier of water of a community water system or a non-community water system may, with the approval of the State and based upon a sanitary survey, substitute the use of chlorine residual monitoring for not more than 75 percent of the samples required to be taken by paragraph (b) of this section, *Provided*, That the supplier of

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water takes chlorine residual samples at points which are representative of the conditions within the distribution system at the frequency of at least four for each substituted microbiological sample. There shall be at least daily determinations of chlorine residual. When the supplier of water exercises the option provided in this paragraph (h) of this section, he shall maintain no less than 0.2 mg/1 free chlorine throughout the public water distribution system. When a particular sampling point has been shown to have a free chlorine residual less than 0.2 mg/1, the water at that location shall be retested as soon as practicable and in any event within one hour. If the original analysis is confirmed, this fact shall be reported to the State within 48 hours. Also, if the analysis is confirmed, a sample for coliform bacterial analysis must be collected from that sampling point as soon as practicable and preferably within one hour, and the results of such analysis reported to the State within 48 hours after the results are known to the supplier of water. Analyses for residual chlorine shall be made in accordance with "Standard Methods for the Examination of Water and Wastewater," 13th Ed., pp. 129–132. Compliance with the maximum contaminant levels for coliform bacteria shall be determined on the monthly mean or quarterly mean basis specified in § 141.14, including those samples taken as a result of failure to maintain the required chlorine residual level. The State may withdraw its approval of the use of chlorine residual substitution at any time.

§ 141.22 Turbidity sampling and analytical requirements.

(a) Samples shall be taken by suppliers of water for both community water systems and non-community water systems at a representative entry point(s) to the water distribution system at least once per day, for the purpose of making turbidity measurements to determine compliance with § 141.13. The measurement shall be made by the Nephelometric Method in accordance with the recommendations set forth in "Standard Methods for the Examination of Water and Wastewater," American Public Health Association, 13th Edition, pp. 350–353, or "Methods for Chemical Analysis of Water and Wastes," pp. 295–298, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

(b) If the result of a turbidity analysis indicates that the maximum allowable limit has been exceeded, the sampling and measurement shall be confirmed by resampling as soon as practicable and preferably within one hour. If the repeat sample confirms that the maximum allowable limit has been exceeded, the supplier of water shall report to the State within 48 hours. The repeat sample shall be the sample used for the purpose of calculating the monthly average. If the monthly average of the daily samples exceeds the maximum allowable limit, or if the average of two samples taken on consecutive days exceeds 5 TU, the supplier of water shall report to the State and notify the public as directed in § 141.31 and § 141.32.

(c) Sampling for non-community water systems shall begin within two years after the effective date of this part.

(d) The requirements of this § 141.22 shall apply only to public water systems which use water obtained in whole or in part from surface sources.

§ 141.23 Inorganic chemical sampling and analytical requirements.

(a) Analyses for the purpose of determining compliance with § 141.11 are required as follows:

(1) Analyses for all community water systems utilizing surface water sources shall be completed within one year following the effective date of this part. These analyses shall be repeated at yearly intervals.

(2) Analyses for all community water systems utilizing only ground water sources shall be completed within two years following the effective date of this part. These analyses shall be repeated at three-year intervals.

(3) For non-community water systems, whether supplied by surface or ground water sources, analyses for nitrate shall be completed within two years following the effective date of this part. These analyses shall be repeated at intervals determined by the State.

(b) If the result of an analysis made pursuant to paragraph (a) indicates that the level of any contaminant listed in § 141.11 exceeds the maximum contaminant level, the supplier of water shall report to the State within 7 days and initiate three additional analyses at the same sampling point within one month.

(c) When the average of four analyses made pursuant to paragraph (b) of this section, rounded to the same number of significant figures as the maximum contaminant level for the substance in question, exceeds the maximum contaminant level, the supplier of water shall notify the State pursuant to § 141.31 and give notice to the public pursuant to § 141.32. Monitoring after public notification shall be at a frequency designated by the State and shall continue until the maximum contaminant level has not been exceeded in two successive samples or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(d) The provisions of paragraphs (b) and (c) of this section notwithstanding, compliance with the maximum contaminant level for nitrate shall be determined on the basis of the mean of two analyses. When a level exceeding the maximum contaminant level for nitrate is found, a second analysis shall be initiated within 24 hours, and if the mean of the two analyses exceeds the maximum contaminant level, the supplier of water shall report his findings to the State pursuant to § 141.31 and shall notify the public pursuant to § 141.32.

(e) For the initial analyses required by paragraph (a)(1), (2) or (3) of this section, data for surface waters acquired within one year prior to the effective date and data for ground waters acquired within 3 years prior to the effective date of this part may be substituted at the discretion of the State.

(f) Analyses conducted to determine compliance with § 141.11 shall be made in accordance with the following methods:

(1) Arsenic—Atomic Absorption Method, "Methods for Chemical Analysis of Water and Wastes," pp. 95–96, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

(2) Barium—Atomic Absorption Method, "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 210–215, or "Methods for Chemical Analysis of Water and Wastes," pp. 97–98, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

(3) Cadmium—Atomic Absorption Method, "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 210–215, or "Methods for Chemical Analysis of Water and Wastes," pp. 101–103, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

(4) Chromium—Atomic Absorption Method, "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 210–215, or "Methods for Chemical Analysis of Water and Wastes," pp. 105–106, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

(5) Lead—Atomic Absorption Method, "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 210–215, or "Methods for Chemical Analysis of Water and Wastes," pp. 112–113, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

(6) Mercury—Flameless Atomic Absorption Method, "Methods for Chemical Analysis of Water and Wastes," pp. 118–126, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

(7) Nitrate—Brucine Colorimetric Method, "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 461–464, or Cadmium Reduction Method, "Methods for Chemical Analysis of Water and Wastes," pp. 201–206, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

(8) Selenium—Atomic Absorption Method, "Methods for Chemical Analysis of Water and Wastes," p. 145, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

(9) Silver—Atomic Absorption Method, "Standard Methods for the Examination of Water and Wastewater", 13th Edition, pp. 210–215, or "Methods for Chemical Analysis of Water and Wastes", p. 146, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

(10) Fluoride—Electrode Method, "Standard Methods for the Examination of Water and Wastewater", 13th Edition,

pp. 172–174, or "Methods for Chemical Analysis of Water and Wastes," pp. 65–67, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974, or Colorimetric Method with Preliminary Distillation. "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 171–172 and 174–176, or "Methods for Chemical Analysis of Water and Wastes," pp. 59–60, Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

§ 141.24 Organic chemical sampling and analytical requirements.

(a) An analysis of substances for the purpose of determining compliance with § 141.12 shall be made as follows:

(1) For all community water systems utilizing surface water sources, analyses shall be completed within one year following the effective date of this part. Samples analyzed shall be collected during the period of the year designated by the State as the period when contamination by pesticides is most likely to occur. These analyses shall be repeated at intervals specified by the State but in no event less frequently than at three year intervals.

(2) For community water systems utilizing only ground water sources, analyses shall be completed by those systems specified by the State.

(b) If the result of an analysis made pursuant to paragraph (a) of this section indicates that the level of any contaminant listed in § 141.12 exceeds the maximum contaminant level, the supplier of water shall report to the State within 7 days and initiate three additional analyses within one month.

(c) When the average of four analyses made pursuant to paragraph (b) of this section, rounded to the same number of significant figures as the maximum contaminant level for the substance in question, exceeds the maximum contaminant level, the supplier of water shall report to the State pursuant to § 141.31 and give notice to the public pursuant to § 141.32. Monitoring after public notification shall be at a frequency designated by the State and shall continue until the maximum contaminant level has not been exceeded in two successive samples or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(d) For the initial analysis required by paragraph (a) (1) and (2) of this section, data for surface water acquired within one year prior to the effective date of this part and data for ground water acquired within three years prior to the effective date of this part may be substituted at the discretion of the State.

(e) Analyses made to determine compliance with § 141.12(a) shall be made in accordance with "Method for Organochlorine Pesticides in Industrial Effluents," MDQARL, Environmental Protection Agency, Cincinnati. Ohio, November 28, 1973.

(f) Analyses made to determine compliance with § 141.12(b) shall be conducted in accordance with "Methods for Chlorinated Phenoxy Acid Herbicides in Industrial Effluents," MDQARL, Environmental Protection Agency, Cincinnati, Ohio, November 28, 1973.

§ 141.25 Analytical Methods for Radioactivity.

[41 FR 28402, July 9, 1976]

(a) The methods specified in *Interim Radiochemical Methodology for Drinking Water,* Environmental Monitoring and Support Laboratory, EPA–600/4–75–008, USEPA, Cincinnati, Ohio 45268, or those listed below, are to be used to determine compliance with §§ 141.15 and 141.16 (radioactivity) except in cases where alternative methods have been approved in accordance with § 141.27.

(1) Gross Alpha and Beta—Method 302 "Gross Alpha and Beta Radioactivity in Water" *Standard Methods for the Examination of Water and Wastewater,* 13th Edition, American Public Health Association, New York, N.Y., 1971.

(2) Total Radium—Method 304 "Radium in Water by Precipitation" Ibid.

(3) Radium-226—Method 305 "Radium-226 by Radon in Water" Ibid.

(4) Strontium-89,90 — Method 303 "Total Strontium and Strontium-90 in Water" Ibid.

(5) Tritium—Method 306 "Tritium in Water" Ibid.

(6) Cesium-134 — ASTM D–2459 "Gamma Spectrometry in Water," *1975 Annual Book of ASTM Standards, Water and Atmospheric Analysis,* Part 31, American Society for Testing and Materials, Philadelphia, PA. (1975).

(7) Uranium—ASTM D–2907 "Microquantities of Uranium in Water by Fluorometry," Ibid.

(b) When the identification and measurement of radionuclides other than those listed in paragraph (a) is required, the following references are to be used, except in cases where alternative methods have been approved in accordance with § 141.27.

(1) *Procedures for Radiochemical Analysis of Nuclear Reactor Aqueous Solutions,* H. L. Krieger and S. Gold, EPA–R4–73–014. USEPA, Cincinnati, Ohio, May 1973.

(2) *HASL Procedure Manual,* Edited by John H. Harley. HASL 300, ERDA Health and Safety Laboratory, New York, N.Y., 1973.

(c) For the purpose of monitoring radioactivity concentrations in drinking water, the required sensitivity of the radioanalysis is defined in terms of a detection limit. The detection limit shall be that concentration which can be counted with a precision of plus or minus 100 percent at the 95 percent confidence level (1.96σ where σ is the standard deviation of the net counting rate of the sample).

(1) To determine compliance with § 141.15 (a) the detection limit shall not exceed 1 pCi/l. To determine compliance with § 141.15(b) the detection limit shall not exceed 3 pCi/l.

(2) To determine compliance with § 141.16 the detection limits shall not exceed the concentrations listed in Table B.

TABLE B.—DETECTION LIMITS FOR MAN-MADE BETA PARTICLE AND PHOTON EMITTERS

Radionuclide	*Detection limit*
Tritium	1,000 pCi/l.
Strontium-89	10 pCi/l.
Strontium-90	2 pCi/l.
Iodine-131	1 pCi/l.
Cesium-134	10 pCi/l.
Gross beta	4 pCi/l.
Other radionuclides	1/10 of the applicable limit.

(d) To judge compliance with the maximum contaminant levels listed in sections 141.15 and 141.16, averages of data shall be used and shall be rounded to the same number of significant figures as the maximum contaminant level for the substance in question.

§ 141.26 Monitoring Frequency for Radioactivity in Community Water Systems.

[41 FR 28402, July 9, 1976]

(a) Monitoring requirements for gross alpha particle activity, radium-226 and radium-228.

(1) Initial sampling to determine compliance with § 141.15 shall begin within two years of the effective date of these regulations and the analysis shall be completed within three years of the effective date of these regulations. Compliance shall be based on the analysis of an annual composite of four consecutive quarterly samples or the average of the analyses of four samples obtained at quarterly intervals.

(i) A gross alpha particle activity measurement may be substituted for the required radium-226 and radium-228 analysis *Provided,* That the measured gross alpha particle activity does not exceed 5 pCi/l at a confidence level of 95 percent (1.65σ where σ is the standard deviation of the net counting rate of the sample). In localities where radium–228 may be present in drinking water, it is recommended that the State require radium–226 and/or radium–228 analyses when the gross alpha particle activity exceeds 2 pCi/1.

(ii) When the gross alpha particle activity exceeds 5 pCi/1, the same or an equivalent sample shall be analyzed for radium–226. If the concentration of radium–226 exceeds 3 pCi/1 the same or an equivalent sample shall be analyzed for radium–228.

(2) For the initial analysis required by paragraph (a) (1), data acquired within one year prior to the effective date of this part may be substituted at the discretion of the State.

(3) Suppliers of water shall monitor at least once every four years following the procedure required by paragraph (a) (1). At the discretion of the State, when an annual record taken in conformance with paragraph (a) (1) has established that the average annual concentration is less than half the maximum contaminant levels established by § 141.15, analysis of a single sample may be substituted for the quarterly sampling procedure required by paragraph (a) (1).

(i) More frequent monitoring shall be conducted when ordered by the State in the vicinity of mining or other operations which may contribute alpha particle radioactivity to either surface or ground water sources of drinking water.

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(ii) A supplier of water shall monitor in conformance with paragraph (a)(1) within one year of the introduction of a new water source for a community water system. More frequent monitoring shall be conducted when ordered by the State in the event of possible contamination or when changes in the distribution system or treatment processing occur which may increase the concentration of radioactivity in finished water.

(iii) A community water system using two or more sources having different concentrations of radioactivity shall monitor source water, in addition to water from a free-flowing tap, when ordered by the State.

(iv) Monitoring for compliance with 141.15 after the initial period need not include radium-228 *except when* required by the State, *Provided*, That the average annual concentration of radium-228 has been assayed at least once using the quarterly sampling procedure required by paragraph (a)(1).

(v) Suppliers of water shall conduct annual monitoring of any community water system in which the radium-226 concentration exceeds 3 pCi/1, when ordered by the State.

(4) If the average annual maximum contaminant level for gross alpha particle activity or total radium as set forth in § 141.15 is exceeded, the supplier of a community water system shall give notice to the State pursuant to § 141.31 and notify the public as required by § 141.32. Monitoring at quarterly intervals shall be continued until the annual average concentration no longer exceeds the maximum contaminant level or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(b) Monitoring requirements for man-made radioactivity in community water systems.

(1) Within two years of the effective date of this part, systems using surface water sources and serving more than 100,000 persons and such other community water systems as are designated by the State shall be monitored for compliance with § 141.16 by analysis of a composite of four consecutive quarterly samples or analysis of four quarterly samples. Compliance with § 141.16 may be assumed without further analysis if the average annual concentration of gross beta particle activity is less than 50 pCi/1 and if the average annual concentrations of tritium and strontium-90 are less than those listed in Table A, *Provided*, That if both radionuclides are present the sum of their annual dose equivalents to bone marrow shall not exceed 4 millirem/year.

(i) If the gross beta particle activity exceeds 50 pCi/1, an analysis of the sample must be performed to identify the major radioactive constituents present and the appropriate organ and total body doses shall be calculated to determine compliance with § 141.16.

(ii) Suppliers of water shall conduct additional monitoring, as ordered by the State, to determine the concentration of man-made radioactivity in principal watersheds designated by the State.

(iii) At the discretion of the State, suppliers of water utilizing only ground waters may be required to monitor for man-made radioactivity.

(2) For the initial analysis required by paragraph (b)(1) data acquired within one year prior to the effective date of this part may be substituted at the discretion of the State.

(3) After the initial analysis required by paragraph (b)(1) suppliers of water shall monitor at least every four years following the procedure given in paragraph (b)(1).

(4) Within two years of the effective date of these regulations the supplier of any community water system designated by the State as utilizing waters contaminated by effluents from nuclear facilities shall initiate quarterly monitoring for gross beta particle and iodine-131 radioactivity and annual monitoring for strontium-90 and tritium.

(i) Quarterly monitoring for gross beta particle activity shall be based on the analysis of monthly samples or the analysis of a composite of three monthly samples. The former is recommended. If the gross beta particle activity in a sample exceeds 15 pCi/1, the same or an equivalent sample shall be analyzed for strontium-89 and cesium-134. If the gross beta particle activity exceeds 50 pCi/1, an analysis of the sample must be performed to identify the major radioactive constituents present and the appropriate organ and total body doses shall be calculated to determine compliance with § 141.16.

(ii) For iodine-131, a composite of five consecutive daily samples shall be analyzed once each quarter. As ordered by the State, more frequent monitoring shall be conducted when iodine-131 is identified in the finished water.

(iii) Annual monitoring for strontium-90 and tritium shall be conducted by means of the analysis of a composite of four consecutive quarterly samples or analysis of four quarterly samples. The latter procedure is recommended.

(iv) The State may allow the substitution of environmental surveillance data taken in conjunction with a nuclear facility for direct monitoring of man-made radioactivity by the supplier of water where the State determines such data is applicable to a particular community water system.

(5) If the average annual maximum contaminant level for man-made radioactivity set forth in § 141.16 is exceeded, the operator of a community water system shall give notice to the State pursuant to § 141.31 and to the public as required by § 141.32. Monitoring at monthly intervals shall be continued until the concentration no longer exceeds the maximum contaminant level or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

§ 141.27 Alternative analytical techniques.

With the written permission of the State, concurred in by the Administrator of the U.S. Environmental Protection Agency, an alternative analytical technique may be employed. An alternative technique shall be acceptable only if it is substantially equivalent to the prescribed test in both precision and accuracy as it relates to the determination of compliance with any maximum contaminant level. The use of the alternative analytical technique shall not decrease the frequency of monitoring required by this part.

§ 141.28 Approved laboratories.

For the purpose of determining compliance with § 141.21 through § 141.27, samples may be considered only if they have been analyzed by a laboratory approved by the State except that measurements for turbidity and free chlorine residual may be performed by any person acceptable to the State.

§ 141.29 Monitoring of consecutive public water systems.

When a public water system supplies water to one or more other public water systems, the State may modify the monitoring requirements imposed by this part to the extent that the interconnection of the sysems jusifies treating them as a single system for monitoring purposes. Any modified monitoring shall be conducted pursuant to a schedule specified by the State and concurred in by the Administrator of the U.S. Environmental Protection Agency.

Subpart D—Reporting, Public Notification and Record Keeping

§ 141.31 Reporting requirements.

(a) Except where a shorter reporting period is specified in this part, the supplier of water shall report to the State within 40 days following a test, measurement or analysis required to be made by this part, the results of that test, measurement or analysis.

(b) The supplier of water shall report to the State within 48 hours the failure to comply with any primary drinking water regulation (including failure to comply with monitoring requirements) set forth in this part.

(c) The supplier of water is not required to report analytical results to the State in cases where a State laboratory performs the analysis and reports the results to the State office which would normally receive such notification from the supplier.

§ 141.32 Public notification.

(a) If a community water system fails to comply with an applicable maximum contaminant level established in Subpart B, fails to comply with an applicable testing procedure established in Subpart C of this part, is granted a variance or an exemption from an applicable maximum contaminant level, fails to comply with the requirements of any schedule prescribed pursuant to a variance or exemption, or fails to perform any monitoring required pursuant to Section 1445 (a) of the Act, the supplier of water shall notify persons served by the system of the failure or grant by inclusion of a notice in the first set of water bills of the system issued after the failure or grant and in any event by written notice within three months. Such notice shall be repeated at least once every three months

so long as the system's failure continues or the variance or exemption remains in effect. If the system issues water bills less frequently than quarterly, or does not issue water bills, the notice shall be made by or supplemented by another form of direct mail.

(b) If a community water system has failed to comply with an applicable maximum contaminant level, the supplier of water shall notify the public of such failure, in addition to the notification required by paragraph (a) of this section, as follows:

(1) By publication on not less than three consecutive days in a newspaper or newspapers of general circulation in the area served by the system. Such notice shall be completed within fourteen days after the supplier of water learns of the failure.

(2) By furnishing a copy of the notice to the radio and television stations serving the area served by the system. Such notice shall be furnished within seven days after the supplier of water learns of the failure.

(c) If the area served by a community water system is not served by a daily newspaper of general circulation, notification by newspaper required by paragraph (b) of this section shall instead be given by publication on three consecutive weeks in a weekly newspaper of general circulation serving the area. If no weekly or daily newspaper of general circulation serves the area, notice shall be given by posting the notice in post offices within the area served by the system.

(d) If a non-community water system fails to comply with an applicable maximum contaminant level established in Subpart B of this part, fails to comply with an applicable testing procedure established in Subpart C of this part, is granted a variance or an exemption from an applicable maximum contaminant level, fails to comply with the requirement of any schedule prescribed pursuant to a variance or exemption or fails to perform any monitoring required pursuant to Section 1445(a) of the Act, the supplier of water shall given notice of such failure or grant to the persons served by the system. The form and manner of such notice shall be prescribed by the State, and shall insure that the public using the system is adequately informed of the failure or grant.

(e) Notices given pursuant to this section shall be written in a manner reasonably designed to inform fully the users of the system. The notice shall be conspicuous and shall not use unduly technical language, unduly small print or other methods which would frustrate the purpose of the notice. The notice shall disclose all material facts regarding the subject including the nature of the problem and, when appropriate, a clear statement that a primary drinking water regulation has been violated and any preventive measures that should be taken by the public. Where appropriate, or where designated by the State, bilingual notice shall be given. Notices may include a balanced explanation of the significance or seriousness to the public health of the subject of the notice, a fair explanation of steps taken by the system to correct any problem and the results of any additional sampling.

(f) Notice to the public required by this section may be given by the State on behalf of the supplier of water.

(g) In any instance in which notification by mail is required by paragraph (a) of this section but notification by newspaper or to radio or television stations is not required by paragraph (b) of this section, the State may order the supplier of water to provide notification by newspaper and to radio and television stations when circumstances make more immediate or broader notice appropriate to protect the public health.

§ 141.33 Record maintenance.

Any owner or operator of a public water system subject to the provisions of this part shall retain on its premises or at a convenient location near its premises the following records:

(a) Records of bacteriological analyses made pursuant to this part shall be kept for not less than 5 years. Records of chemical analyses made pursuant to this part shall be kept for not less than 10 years. Actual laboratory reports may be kept, or data may be transferred to tabular summaries, provided that the following information is included:

(1) The date, place, and time of sampling, and the name of the person who collected the sample;

(2) Identification of the sample as to whether it was a routine distribution system sample, check sample, raw or process water sample or other special purpose sample;

(3) Date of analysis;

(4) Laboratory and person responsible for performing analysis;

(5) The analytical technique/method used; and

(6) The results of the analysis.

(b) Records of action taken by the system to correct violations of primary drinking water regulations shall be kept for a period not less than 3 years after the last action taken with respect to the particular violation involved.

(c) Copies of any written reports, summaries or communications relating to sanitary surveys of the system conducted by the system itself, by a private consultant, or by any local, State or Federal agency, shall be kept for a period not less than 10 years after completion of the sanitary survey involved.

(d) Records concerning a variance or exemption granted to the system shall be kept for a period ending not less than 5 years following the expiration of such variance or exemption.

Subpart E—Special Monitoring Regulations for Organic Chemicals

§ 141.40 Special monitoring for organic chemicals.

(a) The Administrator may designate, by publication in the FEDERAL REGISTER, public water systems which are required to take water samples, provide information, and in appropriate cases analyze water samples for the purpose of providing information on contamination of drinking water sources and of treated water by organic chemicals.

(b) The Administrator shall provide to each public system designated pursuant to paragraph (a) of this section a written schedule for the sampling of source water or treated water by the system, with written instructions for the sampling methods and for handling of samples. The schedule may designate the locations or types of locations to be sampled.

(c) In cases where the public water system has a laboratory capable of analyzing samples for constituents specified by the Administrator, the Administrator may require analyses to be made by the public water system for submission to EPA. If the Administrator requires the analyses to be made by the public water system, he shall provide the system with written instructions as to the analytical procedures to be followed, or with references to technical documents describing the analytical procedures.

(d) Public water systems designated by the Administrator pursuant to paragraph (a) of this section shall provide to the Administrator, upon request, information to be used in the evaluation of analytical results, including records of previous monitoring and analyses, information on possible sources of contamination and treatment techniques used by the system.

(Secs. 1445 and 1450 of the Public Health Service Act, 88 Stat. 1660 (42 U.S.C. 300j–4 and 300j–9))

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Summary of
Interim Primary Drinking Water Regulations

The Interim Primary Drinking Water Regulations, promulgated on December 24, 1975 by the Environmental Protection Agency in accordance with the Safe Drinking Water Act, will become effective in June 1977, and will apply to all drinking water systems that serve at least twenty-five individuals daily or have at least fifteen service connections. These Regulations contain detailed requirements which specify maximum contaminant levels for chemical and microbiological constituents, monitoring frequencies, analytical methods, repeat sampling procedures, public notification and reporting requirements, and record-keeping requirements.

The attached table provides a summary of these provisions, and can be used as an operating guide and convenient reference to the Regulations. The summary is not comprehensive, and should only be used in conjunction with the full text of the Regulations. In particular, the Regulations provide additional information on the distinction between community and non-community water systems, the location of sampling points, laboratory certification requirements, and the mechanism for notifying consumers of violations of the requirements of these Regulations.

TYPE OF CONTAMINANT	NAME OF CONTAMINANT	TYPE OF WATER SYSTEM	MAXIMUM CONTAMINANT LEVEL	MONITORING REQUIREMENT		CHECK SAMPLING, REPORTING, AND PUBLIC NOTICE
				SURFACE ONLY OR COMBINATION	GROUNDWATER ONLY	
Micro-biological	Coliform Bacteria	Community & Noncommunity	Membrane Filter* Coliforms shall not exceed: 1 per 100 ml, mean of all samples per month, 4 per 100 ml in more than one sample if less than 20 samples collected per month, or 4 per 100 ml in more than 5% of samples if 20 or more samples examined per month. Fermentation Tube - 10 ml portion* Coliforms shall not be present in more than 10% of portions per month, Not more than 1 sample may have 3 or more positive portions when less than 20 samples are examined per month, or Not more than 5% of samples may have 3 or more positive portions when 20 or more samples are examined per month. Fermentation Tube - 100 ml portion* Coliforms shall not be present in more than 60% of the portions per month, Not more than 1 sample may have all 5 positive portions when less than 5 samples are examined per month, or Not more than 20% of samples may have all 5 positive portions when 5 or more samples are examined per month. *If sampling rate is less than 4 per month, compliance shall be based on 3 month period unless state determines otherwise.	Community system shall sample at regular time intervals; monthly rate based on population. Noncommunity systems shall sample in each calendar quarter system is operating. (Noncommunity systems may defer monitoring for up to two years after effective date.)	Same as surface except at state option, community systems serving 25-1000 persons may reduce sampling to 1 per quarter. Same as surface.	If MCL is exceeded, report to State within 48 hours and notify public. Membrane Filter If a single sample exceeds 4 per 100 ml, initiate at least two consecutive daily check samples from same sampling point. Collect additional samples daily until at least two consecutive daily check samples show less than 1 per 100 mL If any check sample confirms the presence of coliform, report to the State within 48 hours. Fermentation Tube If a single sample contains coliform in 3 or more 10 ml portions or in all 5 of the 100 ml portions, initiate check sampling as above and continue until at least two consecutive daily check samples show no positive tubes. If any check sample confirms the presence of coliform, report to state within 48 hours.
	Optional Chlorine Residual	Community & Noncommunity	Minimum residual throughout distribution system 0.2 mg/l. (At state option and based on sanitary survey, chlorine residual monitoring may be substituted for not more than 75% of microbiological samples.	At least daily and at a frequency at least 4 times the number of substituted microbiological samples.	Same as surface.	If residual is less than minimum, retest within one hour. If deficient residual is confirmed report to state within 48 hours, and collect coliform bacterial sample within one hour. Report results to state within 48 hours of completion of analysis.

SUMMARY OF
INTERIM PRIMARY DRINKING WATER REGULATIONS
40 CFR 141
Promulgated December 24, 1975 Effective June 24, 1977

TYPE OF CONTAMINANT	NAME OF CONTAMINANT	TYPE OF WATER SYSTEM	MAXIMUM CONTAMINANT LEVEL	MONITORING REQUIREMENT		CHECK SAMPLING, REPORTING, AND PUBLIC NOTICE
				SURFACE ONLY OR COMBINATION	GROUNDWATER ONLY	
Inorganic Chemicals	Arsenic	Community	0.05 mg/l	Analysis completed within one year after effective date. Thereafter at one year intervals.	Analysis completed within two years after effective date. Thereafter at three year intervals.	If any contaminant exceeds MCL, report to state within 7 days and initiate 3 additional samples within one month. When average of the 4 samples exceeds MCL, report to state within 48 hours and notify public.
	Barium		1.			
	Cadmium		0.010			
	Chromium		0.05			
	Lead		0.05			
	Mercury		0.002			
	Selenium		0.01			
	Silver		0.05			
	Fluoride					
	53.7°F & below		2.4			
	53.8 - 58.3		2.2			
	58.4 - 63.8		2.0			
	63.9 - 70.6		1.8			
	70.7 - 79.2		1.6			
	79.3 - 90.5		1.4			
	Nitrate (as N)	Community & Noncommunity	10.	For noncommunity systems (surface or groundwater) analysis for nitrate shall be completed within two years following effective date. Thereafter, at intervals determined by the state.		For nitrate only, when concentration exceeds MCL, initiate a second analysis within 24 hours. When average of two samples exceeds MCL, report to state within 48 hours and notify public.
Organic Chemicals	Endrin	Community	0.0002 mg/l	Analysis completed within one year after effective date. Thereafter at three year intervals.	Analysis only for state-specified water systems.	If any contaminant exceeds MCL, report to state within 7 days and initiate 3 additional samples within one month. When average of the 4 samples exceeds MCL, report to state within 48 hours and notify public.
	Lindane		0.004			
	Methoxychlor		0.1			
	Toxaphene		0.005			
	2,4-D		0.1			
	2,4,5-TP Silvex		0.01			
Turbidity	Turbidity at representative entry point to distribution system.	Community & Noncommunity (surface supplies only)	1 TU monthly average and 5 TU average of two consecutive days (5 TU monthly average may apply at state option.)	One sample/day. (Noncommunity systems may defer monitoring for up to two years after effective date.)	Does not apply.	If a turbidity sample exceeds allowable limit, resample within one hour. If repeat sample confirms limit exceeded, report to state within 48 hours. Using repeat sample to calculate average, if monthly average or two-day average is exceeded report to state within 48 hours and notify public.

SAFE DRINKING WATER ACT

(PL 93-523; Enacted by Congress December 3, 1972; Signed by the President December 17, 1974)

SHORT TITLE

SECTION 1. This Act may be cited as the "Safe Drinking Water Act".

PUBLIC WATER SYSTEMS

SEC. 2. (a) The Public Health Service Act is amended by inserting after title XIII the following new title:

"TITLE XIV—SAFETY OF PUBLIC WATER SYSTEMS

"PART A—DEFINITIONS

"DEFINITIONS

"SEC. 1401. For purposes of this title:

"(1) The term 'primary drinking water regulation' means a regulation which—

"(A) applies to public water systems;

"(B) specifies contaminants which, in the judgment of the Administrator, may have any adverse effect on the health of persons;

"(C) specifies for each such contaminant either—

"(i) a maximum contaminant level, if, in the judgment of the Administrator, it is economically and technologically feasible to ascertain the level of such contaminant in water in public water systems, or

"(ii) if, in the judgment of the Administrator, it is not economically or technologically feasible to so ascertain the level of such contaminant, each treatment technique known to the Administrator which leads to a reduction in the level of such contaminant sufficient to satisfy the requirements of section 1412; and

"(D) contains criteria and procedures to assure a supply of drinking water which dependably complies with such maximum contaminant levels; including quality control and testing procedures to insure compliance with such levels and to insure proper operation and maintenance of the system, and requirements as to (i) the minimum quality of water which may be taken into the system and (ii) siting for new facilities for public water systems.

"(2) The term 'secondary drinking water regulation' means a regulation which applies to public water systems and which specifies the maximum contaminant levels which, in the judgment of the Administrator, are requisite to protect the public welfare. Such regulations may apply to any contaminant in drinking water (A) which may adversely affect the odor or appearance of such water and consequently may cause a substantial number of the persons served by the public water system providing such water to discontinue its use, or (B) which may otherwise adversely affect the public welfare. Such regulations may vary according to geographic and other circumstances.

"(3) The term 'maximum contaminant level means the maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

"(4) The term 'public water system' means a system for the provision to the public of piped water for human consumption, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals. Such term includes (A) any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system, and (B) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system.

"(5) The term 'supplier of water' means any person who owns or operates a public water system.

"(6) The term 'contaminant' means any physical, chemical, biological, or radiological substance or matter in water.

"(7) The term 'Administrator' means the Administrator of the Environmental Protection Agency.

"(8) The term 'Agency' means the Environmental Protection Agency.

"(9) The term 'Council' means the National Drinking Water Advisory Council established under section 1446.

"(10) The term 'municipality' means a city, town, or other public body created by or pursuant to State law, or an Indian tribal organization authorized by law.

"(11) The term 'Federal agency' means any department, agency, or instrumentality of the United States.

"(12) The term 'person' means an individual, corporation, company, association, partnership, State, or municipality.

"PART B—PUBLIC WATER SYSTEMS

"COVERAGE

"SEC. 1411. Subject to sections 1415 and 1416, national primary drinking water regulations under this part shall apply to each public water system in each State; except that such regulations shall not apply to a public water system—

"(1) which consists only of distribution and storage facilities (and does not have any collection and treatment facilities);

"(2) which obtains all of its water from, but is not owned or operated by, a public water system to which such regulations apply;

"(3) which does not sell water to any person; and

"(4) which is not a carrier which conveys passengers in interstate commerce.

"NATIONAL DRINKING WATER REGULATIONS

"SEC. 1412. (a)(1) The Administrator shall publish proposed national interim primary drinking water regulations within 90 days after the date of enactment of this title. Within 180 days after such date of enactment, he shall promulgate such regulations with such modifications as he deems appropriate. Regulations under this paragraph may be amended from time to time.

"(2) National interim primary drinking water regulations promulgated under paragraph (1) shall protect health to the extent feasible, using technology, treatment techniques, and other means, which the Administrator determines are generally available (taking costs into consideration) on the date of enactment of this title.

"(3) The interim primary regulations first promulgated under paragraph (1) shall take effect eighteen months after the date of their promulgation.

"(b)(1)(A) Within 10 days of the date the report on the study conducted pursuant to subsection (e) is submitted to Congress, the Administrator shall publish in the Federal Register, and provide opportunity for comment on, the—

"(i) proposals in the report for recommended maximum contaminant levels for national primary drinking water regulations, and

"(ii) list in the report of contaminants the levels of which in drinking water cannot be determined but which may have an adverse effect on the health of persons.

"(B) Within 90 days after the date the Administrator makes the publication required by subparagraph (A), he shall by rule establish recommended maximum contaminant levels for each contaminant which, in his judgment based on the report on the study conducted pursuant to subsection (e), may have any adverse effect on the health of persons. Each such recommended maximum contaminant level shall be set at a level at which, in the Administrator's judgment based on such report, no known or anticipated adverse effects on the health of persons occur and which allows an adequate margin of safety. In addition, he shall, on the basis of the report on the study conducted pursuant to subsection (e), list in the rules under this subparagraph any contaminant the level of which cannot be accurately enough measured in drinking water to establish a recommended maximum contaminant level and which may have any adverse effect on the health of persons. Based on information available to him, the Administrator may by rule change recommended levels established under this subparagraph or change such list.

"(2) On the date the Administrator establishes pursuant to paragraph (1)(B) recommended maximum contaminant levels he shall publish in the Federal Register proposed revised national primary drinking water regulations (meeting the requirements of paragraph (3)). Within 180 days after the date of such proposed regulations, he shall promulgate such revised drinking water regulations with such modifications as he deems appropriate.

"(3) Revised national primary drinking water regulations promulgated under paragraph (2) of this subsection shall be primary drinking water regulations which specify a maximum contaminant level or require the use of treatment techniques for each contaminant for which a recommended maximum contaminant level is established or which is listed in a rule under paragraph (1)(B). The maximum contaminant level specified in a revised national primary drinking water regulation for a contaminant shall be as close to the recommended maximum contaminant level established under paragraph (1)(B) for such contaminant as is feasible. A required treatment technique for a contaminant for which a recommended maximum contaminant level has been established under paragraph (1)(B) shall reduce such contaminant to a level which is as close to the recommended maximum contaminant level for such contaminant as is feasible. A required treatment technique for a contaminant which is listed under paragraph (1)(B) shall require treatment necessary in the Administrator's judgment to prevent known or anticipated adverse effects on the health of persons to the extent feasible. For purposes of this paragraph, the term 'feasible' means feasible with the use of the best technology, treatment techniques, and other means, which the Administrator finds are generally available (taking cost into consideration).

"(4) Revised national primary drinking water regulations shall be amended whenever changes in technology, treatment techniques, and other means permit greater protection of the health of persons, but in any event such regulations shall be reviewed at least once every 3 years.

"(5) Revised national primary drinking water regulations promulgated under this subsection (and amendments thereto) shall take effect eighteen months after the date of their promulgation. Regulations under subsection (a) shall be superseded by regulations under this subsection to the extent provided by the regulations under this subsection.

"(6) No national primary drinking water regulation may require the addition of any substance for preventive health care purposes unrelated to contamination of drinking water.

"(c) The Administrator shall publish proposed national secondary drinking water regulations within 270 days after the date of enactment of this title. Within 90 days after publication of any such regulation, he shall promulgate such regulation with such modifications as he deems appropriate. Regulations under this subsection may be amended from time to time.

"(d) Regulations under this section shall be prescribed in accordance with section 553 of title 5, United States Code (relating to rulemaking), except that the Administrator shall provide opportunity for public hearing prior to promulgation of such regulations. In proposing and promulgating regulations

under this section, the Administrator shall consult with the Secretary and the National Drinking Water Advisory Council.

"(c)(1) The Administrator shall enter into appropriate arrangements with the National Academy of Sciences (or with another independent scientific organization if appropriate arrangements cannot be made with such Academy) to conduct a study to determine (A) the maximum contaminant levels which should be recommended under subsection (b)(2) in order to protect the health of persons from any known or anticipated adverse effects, and (B) the existence of any contaminants the levels of which in drinking water cannot be determined but which may have an adverse effect on the health of persons.

"(2) The result of the study shall be reported to Congress no later than 2 years after the date of enactment of this title. The report shall contain (A) a summary and evaluation of relevant publications and unpublished studies; (B) a statement of methodologies and assumptions for estimating the levels at which adverse health effects may occur; (C) a statement of methodologies and assumptions for estimating the margin of safety which should be incorporated in the national primary drinking water regulations; (D) proposals for recommended maximum contaminant levels for national primary drinking water regulations, based on the methodologies, assumptions, and studies referred to in clauses (A), (B), and (C) and in paragraph (4); (E) a list of contaminants the level of which in drinking water cannot be determined but which may have an adverse effect on the health of persons; and (F) recommended studies and test protocols for future research on the health effects of drinking water contaminants, including a list of the major research priorities and estimated costs necessary to conduct such priority research.

"(3) In developing its proposals for recommended maximum contaminant levels under paragraph (2)(D) the National Academy of Sciences (or other organization preparing the report) shall evaluate and explain (separately and in composite) the impact of the following considerations:

"(A) The existence of groups or individuals in the population which are more susceptible to adverse effects than the normal healthy adult.

"(B) The exposure to contaminants in other media than drinking water (including exposures in food, in the ambient air, and in occupational settings) and the resulting body burden of contaminants.

"(C) Synergistic effects resulting from exposure to or interaction by two or more contaminants.

"(D) The contaminant exposure and body burden levels which alter physiological function or structure in a manner reasonably suspected of increasing the risk of illness.

"(4) In making the study under this subsection, the National Academy of Sciences (or other organization) shall collect and correlate (A) morbidity and mortality data and (B) monitored data on the quality of drinking water. Any conclusions based on such correlation shall be included in the report of the study.

"(5) Neither the report of the study under this subsection nor any draft of such report shall be submitted to the Office of Management and Budget or to any other Federal agency (other than the Environmental Protection Agency) prior to its submission to Congress.

"(6) Of the funds authorized to be appropriated to the Administrator by this title, such amounts as may be required shall be available to carry out the study and to make the report directed by paragraph (2) of this subsection.

"STATE PRIMARY ENFORCEMENT RESPONSIBILITY

"SEC. 1413. (a) For purposes of this title, a State has primary enforcement responsibility for public water systems during any period for which the Administrator determines (pursuant to regulations prescribed under subsection (b)) that such State—

"(1) has adopted drinking water regulations which (A) in the case of the period beginning on the date the national interim primary drinking water regulations are promulgated under section 1412 and ending on the date such regulations take effect are no less stringent than such regulations, and (B) in the case of the period after such effective date are no less stringent than the interim and revised national primary drinking water regulations in effect under such section;

"(2) has adopted and is implementing adequate procedures for the enforcement of such State regulations including conducting such monitoring and making such inspections as the Administrator may require by regulation;

"(3) will keep such records and make such reports with respect to its activities under paragraphs (1) and (2) as the Administrator may require by regulation;

"(4) if it permits variances or exemptions, or both, from the requirements of its drinking water regulations which meet the requirements of paragraph (1), permits such variances and exemptions under conditions and in a manner which is not less stringent than the conditions under, and the manner in, which variances and exemptions may be granted under sections 1415 and 1416; and

"(5) has adopted and can implement an adequate plan for the provision of safe drinking water under emergency circumstances.

"(b)(1) The Administrator shall, by regulation (proposed within 180 days of the date of the enactment of this title), prescribe the manner in which a State may apply to the Administrator for a determination that the requirements of paragraphs (1), (2), (3), and (4) of subsection (a) are satisfied with respect to the State, the manner in which the determination is made, the period for which the determination will be effective, and the manner in which the Administrator may determine that such requirements are no longer met. Such regulations shall require that before a determination of the Administrator that such requirements are met are no longer met with respect to a State may become effective, the Administrator shall notify such State of the determination and the reasons therefor and shall provide an opportunity for public hearing on the determination. Such regulations shall be promulgated (with such modifications as the Administrator deems appropriate) within 90 days of the publication of the proposed regulations in the Federal Register. The Administrator shall promptly notify in writing the chief executive officer of each State of the promulgation of regulations under this paragraph. Such notice shall contain a copy of the regulations and shall specify a State's authority under this title when it is determined to have primary enforcement responsibility for public water systems.

"(2) When an application is submitted in accordance with the Administrator's regulations under paragraph (1), the Administrator shall within 90 days of the date on which such application is submitted (A) make the determination applied for, or (B) deny the application and notify the applicant in writing of the reasons for his denial.

"FAILURE BY STATE TO ASSURE ENFORCEMENT OF DRINKING WATER REGULATIONS

"SEC. 1414. (a)(1)(A) Whenever the Administrator finds during a period during which a State has primary enforcement responsibility for public water systems (within the meaning of section 1413(a)) that any public water system—

"(i) for which a variance under section 1415 or an exemption under section 1416 is not in effect, does not comply with any national primary drinking water regulation in effect under section 1412, or

"(ii) for which a variance under section 1415 or an exemption under section 1416 is in effect, does not comply with any schedule, or other requirement imposed pursuant thereto,

he shall so notify the State and provide such advice and technical assistance to such State and public water system as may be appropriate to bring the system into compliance with such regulation or requirement by the earliest feasible time.

"(B) If the Administrator finds such failure to comply extends beyond the thirtieth day after the date of the notice given pursuant to subparagraph (A), he shall give public notice of such finding and request the State to report within fifteen days from the date of such public notice as to the steps being taken to bring the system into compliance (including reasons for anticipated steps to be taken to bring the system into compliance and for any failure to take steps to bring the system into compliance). If—

"(i) such failure to comply extends beyond the sixtieth day after the date of the notice given pursuant to subparagraph (A); and

"(ii) (α) the State fails to submit the report requested by the Administrator within the time period prescribed by the preceding sentence; or

"(β) the State submits such report within such period but the Administrator, after considering the report, determines that the State abused its discretion in carrying out primary enforcement responsibility for public water systems by both—

(I) failing to implement by such sixtieth day adequate procedures to bring the system into compliance by the earliest feasible time, and

(II) failing to assure by such day the provision through alternative means of safe drinking water by the earliest feasible time;

the Administrator may commence a civil action under subsection (b).

"(2) Whenever, on the basis of information available to him, the Administrator finds during a period during which a State does not have primary enforcement responsibility for public water systems that a public water system in such State—

"(A) for which a variance under section 1415(a)(2) or an exemption under section 1416(f) is not in effect, does not comply with any national primary drinking water regulation in effect under section 1412, or

"(B) for which a variance under section 1415(a)(2) or an exemption under section 1416(f) is in effect, does not comply with any schedule or other requirement imposed pursuant thereto,

he may commence a civil action under subsection (b).

"(b) The Administrator may bring a civil action in the appropriate United States district court to require compliance with a national primary drinking water regulation or with any schedule or other requirement imposed pursuant to a variance or exemption granted under section 1415 or 1416 if—

"(1) authorized under paragraph (1) or (2) of subsection (a), or

"(2) if requested by (A) the chief executive officer of the State in which is located the public water system which is not in compliance with such regulation or requirement, or (B) the agency of such State which has jurisdiction over compliance by public water systems in the State with national

primary drinking water regulations or State drinking water regulations.

The court may enter, in an action brought under this subsection, such judgment as protection of public health may require, taking into consideration the time necessary to comply and the availability of alternative water supplies; and, if the court determines that there has been a willful violation of the regulation or schedule or other requirement with respect to which the action was brought, the court may, taking into account the seriousness of the violation, the population at risk, and other appropriate factors, impose on the violator a civil penalty of not to exceed $5,000 for each day in which such violation occurs.

"(c) Each owner or operator of a public water system shall give notice to the persons served by it—

"(1) of any failure on the part of the public water system to—

"(A) comply with an applicable maximum contaminant level or treatment technique requirement of, or a testing procedure prescribed by, a national primary drinking water regulation, or

"(B) perform monitoring required by section 1445(a), and

"(2) if the public water system is subject to a variance granted under section 1415(a)(1)(A) or 1415(a)(2) for an inability to meet a maximum contaminant level requirement or is subject to an exemption granted under section 1416, of—

"(A) the existence of such variance or exemption, and

"(B) any failure to comply with the requirements of any schedule prescribed pursuant to the variance or exemption.

The Administrator shall by regulation prescribe the form and manner for giving such notice. Such notice shall be given not less than once every 3 months, shall be given by publication in a newspaper of general circulation serving the area served by each such water system (as determined by the Administrator), shall be furnished to the other communications media serving such area, and shall be furnished to the communications media as soon as practicable after the discovery of the violation with respect to which the notice is required. If the water bills of a public water system are issued more often than once every 3 months, such notice shall be included in at least one water bill of the system every 3 months, and if a public water system issues its water bills less often than once every 3 months, such notice shall be included in each of the water bills issued by the system. Any person who willfully violates this subsection or regulations thereunder shall be fined not more than $5,000.

"(d) Whenever, on the basis of information available to him, the Administrator finds that within a reasonable time after national secondary drinking water regulations have been promulgated, one or more public water systems in a State do not comply with such secondary regulations, and that such noncompliance appears to result from a failure of such State to take reasonable action to assure that public water systems throughout such State meet such secondary regulations, he shall so notify the State.

"(e) Nothing in this title shall diminish any authority of a State or political subdivision to adopt or enforce any law or regulation respecting drinking water regulations or public water systems, but no such law or regulation shall relieve any person of any requirement otherwise applicable under this title.

"(f) If the Administrator makes a finding of noncompliance (described in subparagraph (A) or (B) of subsection (a)(1)) with respect to a public water system in a State which has primary enforcement responsibility, the Administrator may, for the purpose of assisting that State in carrying out such responsibility and upon the petition of such State or public water system or persons served by such system, hold, after appropriate notice, public hearings for the purpose of gathering information from technical or other experts, Federal, State, or other public officials, representatives of such public water system, persons served by such system, and other interested persons on—

"(1) the ways in which such system can within the earliest feasible time be brought into compliance with the regulation or requirement with respect to which such finding was made, and

"(2) the means for the maximum feasible protection of the public health during any period in which such system is not in compliance with a national primary drinking water regulation or requirement applicable to a variance or exemption.

On the basis of such hearings the Administrator shall issue recommendations which shall be sent to such State and public water system and shall be made available to the public and communications media.

"VARIANCES

"SEC. 1415. (a) Notwithstanding any other provision of this part, variances from national primary drinking water regulations may be granted as follows:

"(1)(A) A State which has primary enforcement responsibility for public water systems may grant one or more variances from an applicable national primary drinking water regulation to one or more public water systems within its jurisdiction which, because of characteristics of the raw water sources which are reasonably available to the systems, cannot meet the requirements respecting the maximum contaminant levels of such drinking water regulation despite application of the best technology, treatment techniques, or other means, which the Administrator finds are generally available (taking costs into consideration). Before a State may grant a variance under this subparagraph, the State must find that the variance will not result in an unreasonable risk to health. If a State grants a public water system a variance under this subparagraph, the State shall prescribe within one year of the date the variance is granted, a schedule for—

"(i) compliance (including increments of progress) by the public water system with each contaminant level requirement with respect to which the variance was granted, and

"(ii) implementation by the public water system of such control measures as the State may require for each contaminant, subject to such contaminant level requirement, during the period ending on the date compliance with such requirement is required.

Before a schedule prescribed by a State pursuant to this subparagraph may take effect, the State shall provide notice and opportunity for a public hearing on the schedule. A notice given pursuant to the preceding sentence may cover the prescribing of more than one such schedule and a hearing held pursuant to such notice shall include each of the schedules covered by the notice. A schedule prescribed pursuant to this subparagraph for a public water system granted a variance shall require compliance by the system with each contaminant level requirement with respect to which the variance was granted as expeditiously as practicable (as the State may reasonably determine).

"(B) A State which has primary enforcement responsibility for public water systems may grant to one or more public water systems within its jurisdiction one or more variances from any provision of a national primary drinking water regulation which requires the use of a specified treatment technique with respect to a contaminant if the public water system applying for the variance demonstrates to the satisfaction of the State that such treatment technique is not necessary to protect the health of persons because of the nature of the raw water source of such system. A variance granted under this subparagraph shall be conditioned on such monitoring and other requirements as the Administrator may prescribe.

"(C) Before a variance proposed to be granted by a State under subparagraph (A) or (B) may take effect, such State shall provide notice and opportunity for public hearing on the proposed variance. A notice given pursuant to the preceding sentence may cover the granting of more than one variance and a hearing held pursuant to such notice shall include each of the variances covered by the notice. The State shall promptly notify the Administrator of all variances granted by it. Such notification shall contain the reason for the variance (and in the case of a variance under subparagraph (A), the basis for the finding required by that subparagraph before the granting of the variance) and documentation of the need for the variance.

"(D) Each public water system's variance granted by a State under subparagraph (A) shall be conditioned by the State upon compliance by the public water system with the schedule prescribed by the State pursuant to that subparagraph. The requirements of each schedule prescribed by a State pursuant to that subparagraph shall be enforceable by the State under its laws. Any requirement of a schedule on which a variance granted under that subparagraph is conditioned may be enforced under section 1414 as if such requirement was part of a national primary drinking water regulation.

"(E) Each schedule prescribed by a State pursuant to subparagraph (A) shall be deemed approved by the Administrator unless the variance for which it was prescribed is revoked by the Administrator under subparagraph (G) or the schedule is revised by the Administrator under such subparagraph.

"(F) Not later than 18 months after the effective date of the interim national primary drinking water regulations the Administrator shall complete a comprehensive review of the variances granted under subparagraph (A) (and schedules prescribed pursuant thereto) and under subparagraph (B) by the States during the one-year period beginning on such effective date. The Administrator shall conduct such subsequent reviews of variances and schedules as he deems necessary to carry out the purposes of this title, but each subsequent review shall be completed within each 3-year period following the completion of the first review under this subparagraph. Before conducting any review under this subparagraph, the Administrator shall publish notice of the proposed review in the Federal Register. Such notice shall (i) provide information respecting the location of data and other information respecting the variances to be reviewed (including data and other information concerning new scientific matters bearing on such variances), and (ii) advise of the opportunity to submit comments on the variances reviewed and on the need for continuing them. Upon completion of any such review, the Administrator shall publish in the Federal Register the results of his review together with findings responsive to comments submitted in connection with such review.

"(G)(1) If the Administrator finds that a State has, in a substantial number of instances, abused its discretion in granting variances under subparagraph (A) or (B) or that in a substantial number of cases the State has failed to prescribe schedules in accordance with subparagraph (A), the Administrator shall notify the State of his findings. In determining if a State has abused its discretion in granting variances in a substantial number of instances, the Administrator shall consider the number of persons

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who are affected by the variances and if the requirements applicable to the granting of the variances were complied with. A notice under this clause shall—

"(I) identify each public water system with respect to which the finding was made,

"(II) specify the reasons for the finding, and

"(III) as appropriate, propose revocations of specific variances or propose revised schedules or other requirements for specific public water systems granted variances, or both.

"(ii) The Administrator shall provide reasonable notice and public hearing on the provisions of each notice given pursuant to clause (i) of this subparagraph. After a hearing on a notice pursuant to such clause, the Administrator shall (I) rescind the finding for which the notice was given and promptly notify the State of such rescission, or (II) promulgate (with such modifications as he deems appropriate) such variance revocations and revised schedules or other requirements proposed in such notice as he deems appropriate. Not later than 180 days after the date a notice is given pursuant to clause (i) of this subparagraph, the Administrator shall complete the hearing on the notice and take the action required by the preceding sentence.

"(iii) If a State is notified under clause (i) of this subparagraph of a finding of the Administrator made with respect to a variance granted a public water system within that State or to a schedule or other requirement for a variance and if, before a revocation of such variance or a revision of such schedule or other requirement promulgated by the Administrator takes effect, the State takes corrective action with respect to such variance or schedule or other requirement which the Administrator determines makes his finding inapplicable to such variance or schedule or other requirement, the Administrator shall rescind the application of his finding to that variance or schedule or other requirement. No variance revocation or revised schedule or other requirement may take effect before the expiration of 90 days following the date of the notice in which the revocation or revised schedule or other requirement was proposed.

"(2) If a State does not have primary enforcement responsibility for public water systems, the Administrator shall have the same authority to grant variances in such State as the State would have under paragraph (1) if it had primary enforcement responsibility.

"(3) The Administrator may grant a variance from any treatment technique requirement of a national primary drinking water regulation upon a showing by any person that an alternative treatment technique not included in such requirement is at least as efficient in lowering the level of the contaminant with respect to which such requirement was prescribed. A variance under this paragraph shall be conditioned on the use of the alternative treatment technique which is the basis of the variance.

"(b) Any schedule or other requirement on which a variance granted under paragraph (1)(B) or (2) of subsection (a) is conditioned may be enforced under section 1414 as if such schedule or other requirement was part of a national primary drinking water regulation.

"(c) If an application for a variance under subsection (a) is made, the State receiving the application or the Administrator, as the case may be, shall act upon such application within a reasonable period (as determined under regulations prescribed by the Administrator) after the date of its submission.

"(d) For purposes of this section, the term 'treatment technique requirement' means a requirement in a national primary drinking water regulation which specifies for a contaminant (in accordance with section 1401(1)(C)(ii)) each treatment technique known to the Administrator which leads to a reduction in the level of such contaminant sufficient to satisfy the requirements of section 1412(b)(3).

"EXEMPTIONS

"SEC. 1416. (a) A State which has primary enforcement responsibility may exempt any public water system within the State's jurisdiction from any requirement respecting a maximum contaminant level or any treatment technique requirement, or from both, of an applicable national primary drinking water regulation upon a finding that—

"(1) due to compelling factors (which may include economic factors), the public water system is unable to comply with such contaminant level or treatment technique treatment,

"(2) the public water system was in operation on the effective date of such contaminant level or treatment technique requirement, and

"(3) the granting of the exemption will not result in an unreasonable risk to health.

"(b)(1) If a State grants a public water system an exemption under subsection (a), the State shall prescribe, within one year of the date the exemption is granted, a schedule for—

"(A) compliance (including increments of progress) by the public water system with each contaminant level requirement and treatment technique requirement with respect to which the exemption was granted, and

"(B) implementation by the public water system of such control measures as the State may require for each contaminant, subject to such contaminant level requirement or treatment technique requirement, during the period ending on the date compliance with such requirement is required.

Before a schedule prescribed by a State pursuant to this subsection may take effect, the State shall provide notice and opportunity for a public hearing on the schedule. A notice given pursuant to the preceding sentence may cover the prescribing of more than one such schedule and a hearing held pursuant to such notice shall include each of the schedules covered by the notice.

"(2)(A) A schedule prescribed pursuant to this subsection for a public water system granted an exemption under subsection (a) shall require compliance by the system with each contaminant level and treatment technique requirement with respect to which the exemption was granted as expeditiously as practicable (as the State may reasonably determine) but (except as provided in subparagraph (B))—

"(i) in the case of an exemption granted with respect to a contaminant level or treatment technique requirement prescribed by the interim national primary drinking water regulations promulgated under section 1412(a), not later than January 1, 1981; and

"(ii) in the case of an exemption granted with respect to a contaminant level or treatment technique requirement prescribed by revised national primary drinking water regulations, not later than seven years after the date such requirement takes effect.

"(B) Notwithstanding clauses (i) and (ii) of subparagraph (A) of this paragraph, the final date for compliance prescribed in a schedule prescribed pursuant to this subsection for an exemption granted for a public water system which (as determined by the State granting the exemption) has entered into an enforceable agreement to become a part of a regional public water system shall—

"(i) in the case of a schedule prescribed for an exemption granted with respect to a contaminant level or treatment technique requirement prescribed by interim national primary drinking water regulations, be not later than January 1, 1983; and

"(ii) in the case of a schedule prescribed for an exemption granted with respect to a contaminant level or treatment technique requirement prescribed by revised national primary drinking water regulations, be not later than nine years after such requirement takes effect.

"(3) Each public water system's exemption granted by a State under subsection (a) shall be conditioned by the State upon compliance by the public water system with the schedule prescribed by the State pursuant to this subsection. The requirements of each schedule prescribed by a State pursuant to this subsection shall be enforceable by the State under its laws. Any requirement of a schedule on which an exemption granted under this section is conditioned may be enforced under section 1414 as if such requirement was part of a national primary drinking water regulation.

"(4) Each schedule prescribed by a State pursuant to this subsection shall be deemed approved by the Administrator unless the exemption for which it was prescribed is revoked by the Administrator under subsection (d)(2) or the schedule is revised by the Administrator under such subsection.

"(c) Each State which grants an exemption under subsection (a) shall promptly notify the Administrator of the granting of such exemption. Such notification shall contain the reasons for the exemption (including the basis for the finding required by subsection (a)(3) before the exemption may be granted) and document the need for the exemption.

"(d)(1) Not later than 18 months after the effective date of the interim national primary drinking water regulations the Administrator shall complete a comprehensive review of the exemptions granted (and schedules prescribed pursuant thereto) by the States during the one-year period beginning on such effective date. The Administrator shall conduct such subsequent reviews of exemptions and schedules as he deems necessary to carry out the purposes of this title, but each subsequent review shall be completed within each 3-year period following the completion of the first review under this subparagraph. Before conducting any review under this subparagraph, the Administrator shall publish notice of the proposed review in the Federal Register. Such notice shall (A) provide information respecting the location of data and other information respecting the exemptions to be reviewed (including data and other information concerning new scientific matters bearing on such exemptions), and (B) advise of the opportunity to submit comments on the exemptions reviewed and on the need for continuing them. Upon completion of any such review, the Administrator shall publish in the Federal Register the results of his review together with findings responsive to comments submitted in connection with such review.

"(2)(A) If the Administrator finds that a State has, in a substantial number of instances, abused its discretion in granting exemptions under subsection (a) or failed to prescribe schedules in accordance with subsection (b), the Administrator shall notify the State of his finding. In determining if a State has abused its discretion in granting exemptions in a substantial number of instances, the Administrator shall consider the number of persons who are affected by the exemptions and if the requirements applicable to the granting of the exemptions were complied with. A notice under this subparagraph shall—

"(i) identify each exempt public water system with respect to which the finding was made,

"(ii) specify the reasons for the finding, and

"(iii) as appropriate, propose revocations of specific exemptions or propose revised schedules for specific exempt public water systems, or both.

"(B) The Administrator shall provide reasonable notice and public hearing on the provisions of each notice given pursuant to subparagraph (A). After a hearing on a notice pursuant to subparagraph (A), the Administrator shall (i) rescind the finding for which the notice was given and promptly notify the State of such rescission, or (ii) promulgate (with such modifications as he deems appropriate) such exemption revocations and revised schedules proposed in such notice as he deems appropriate. Not later than 180 days after the date a notice is given pursuant to subparagraph (A), the Administrator shall complete the hearing on the notice and take the action required by the preceding sentence.

"(C) If a State is notified under subparagraph (A) of a finding of the Administrator made with respect to an exemption granted a public water system within that State or to a schedule prescribed pursuant to such an exemption and if before a revocation of such exemption or a revision of such schedule promulgated by the Administrator takes effect the State takes corrective action with respect to such exemption or schedule which the Administrator determines makes his finding inapplicable to such exemption or schedule, the Administrator shall rescind the application of his finding to that exemption or schedule. No exemption revocation or revised schedule may take effect before the expiration of 90 days following the date of the notice in which the revocation or revised schedule was proposed.

"(e) For purposes of this section, the term 'treatment technique requirement' means a requirement in a national primary drinking water regulation which specifies for a contaminant (in accordance with section 1401 (1)(C)(ii)) each treatment technique known to the Administrator which leads to a reduction in the level of such contaminant sufficient to satisfy the requirements of section 1412(b)(3).

"(f) If a State does not have primary enforcement responsibility for public water systems, the Administrator shall have the same authority to exempt public water systems in such State from maximum contaminant level requirements and treatment technique requirements under the same conditions and in the same manner as the State would be authorized to grant exemptions under this section if it had primary enforcement responsibility.

"(g) If an application for an exemption under this section is made, the State receiving the application or the Administrator, as the case may be, shall act upon such application within a reasonable period (as determined under regulations prescribed by the Administrator) after the date of its submission.

"PART C—PROTECTION OF UNDERGROUND SOURCES OF DRINKING WATER

"REGULATIONS FOR STATE PROGRAMS

"SEC. 1421. (a)(1) The Administrator shall publish proposed regulations for State undergound injection control programs within 180 days after the date of enactment of this title. Within 180 days after publication of such proposed regulations, he shall promulgate such regulations with such modifications as he deems appropriate. Any regulation under this subsection may be amended from time to time.

"(2) Any regulation under this section shall be proposed and promulgated in accordance with section 553 of title 5, United States Code (relating to rulemaking), except that the Administrator shall provide opportunity for public hearing prior to promulgation of such regulations. In proposing and promulgating regulations under this section, the Administrator shall consult with the Secretary, the National Drinking Water Advisory Council, and other appropriate Federal entities and with interested State entities.

"(b)(1) Regulations under subsection (a) for State underground injection programs shall contain minimum requirements for effective programs to prevent underground injection which endangers drinking water sources within the meaning of subsection (d)(2). Such regulations shall require that a State program, in order to be approved under section 1422—

"(A) shall prohibit, effective three years after the date of the enactment of this title, any underground injection in such State which is not authorized by a permit issued by the State (except that the regulations may permit a State to authorize underground injection by rule);

"(B) shall require (i) in the case of a program which provides for authorization of underground injection by permit, that the applicant for the permit to inject must satisfy the State that the underground injection will not endanger drinking water sources, and (ii) in the case of a program which provides for such an authorization by rule, that no rule may be promulgated which authorizes any underground injection which endangers drinking water sources;

"(C) shall include inspection, monitoring, recordkeeping, and reporting requirements; and

"(D) shall apply (i) as prescribed by section 1447 (b), to underground injections by Federal agencies, and (ii) to underground injections by any other person whether or not occurring on property owned or leased by the United States.

"(2) Regulations of the Administrator under this section for State underground injection control programs may not prescribe requirements which interfere with or impede—

"(A) the underground injection of brine or other fluids which are brought to the surface in connection with oil or natural gas production, or

"(B) any underground injection for the secondary or tertiary recovery of oil or natural gas,

unless such requirements are essential to assure that underground sources of drinking water will not be endangered by such injection.

"(c)(1) The Administrator may, upon application of the Governor of a State which authorizes underground injection by means of permits, authorize such State to issue (without regard to subsection (b)(1)(B)(i)) temporary permits for underground injection which may be effective until the expiration of four years after the date of enactment of this title, if—

"(A) the Administrator finds that the State has demonstrated that it is unable and could not reasonably have been able to process all permit applications within the time available;

"(B) the Administrator determines the adverse effect on the environment of such temporary permits is not unwarranted;

"(C) such temporary permits will be issued only with respect to injection wells in operation on the date on which such State's permit program approved under this part first takes effect and for which there was inadequate time to process its permit application; and

"(D) the Administrator determines the temporary permits require the use of adequate safeguards established by rules adopted by him.

"(2) The Administrator may, upon application of the Governor of a State which authorizes underground injection by means of permits, authorize such State to issue (without regard to subsection (b)(1)(B)(i)), but after reasonable notice and public hearing, one or more temporary permits each of which is applicable to a particular injection well and to the underground injection of a particular fluid and which may be effective until the expiration of four years after the date of enactment of this title, if the State finds, on the record of such hearing—

"(A) that technology (or other means) to permit safe injection of the fluid in accordance with the applicable underground injection control program is not generally available (taking costs into consideration);

"(B) that injection of the fluid would be less harmful to health than the use of other available means of disposing of waste or producing the desired product; and

"(C) that available technology or other means have been employed (and will be employed) to reduce the volume and toxicity of the fluid and to minimize the potentially adverse effect of the injection on the public health.

"(d) For purposes of this part:

"(1) The term 'underground injection' means the subsurface emplacement of fluids by well injection.

"(2) Underground injection endangers drinking water sources if such injection may result in the presence in underground water which supplies or can reasonably be expected to supply any public water system of any contaminant, and if the presence of such contaminant may result in such system's not complying wtih any national primary drinking water regulation or may otherwise adversely affect the health of persons.

"STATE PRIMARY ENFORCEMENT RESPONSIBILITY

"SEC. 1422. (a) Within 180 days after the date of enactment of this title, the Administrator shall list in the Federal Register each State for which in his judgment a State underground injection control program may be necessary to assure that underground injection will not endanger drinking water sources. Such list may be amended from time to time.

"(b)(1)(A) Each State listed under subsection (a) shall within 270 days after the date of promulgation of any regulation under section 1421 (or, if later, within 270 days after such State is first listed under subsection (a)) submit to the Administrator an application which contains a showing satisfactory to the Administrator that the State—

"(i) has adopted after reasonable notice and public hearings, and will implement, an underground injection control program which meets the requirements of regulations in effect under section 1421; and

"(ii) will keep such records and make such report with respect to its activities under its underground injection control program as the Administrator may require by regulation.

"(B) Within 270 days of any amendment of a regulation under section 1421 revising or adding any requirement respecting State underground injection control programs, each State listed under subsection (a) shall submit (in such form and manner as the Administrator may require) a notice to the Administrator containing a showing satisfactory to him that the State underground injection control program meets the revised or added requirement.

"(2) Within ninety days after the State's application under paragraph (1)(A) or notice under paragraph (1)(B) and after reasonable opportunity for presentation of views, the Administrator shall by rule either approve, disapprove, or approve in part and disapprove in part, the State's underground injection control program.

"(3) If the Administrator approves the State's program under paragraph (2), the State shall have primary enforcement responsibility for underground water sources until such time as the Administrator determines, by rule, that such State no longer meets the requirements of clause (i) or (ii) of paragraph (1)(A) of this subsection.

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"(4) Before promulgating any rule under paragraph (2) or (3) of this subsection, the Administrator shall provide opportunity for public hearing respecting such rule.

"(c) If the Administrator disapproves a State's program (or part thereof) under subsection (b)(2), if the Administrator determines under subsection (b)(3) that a State no longer meets the requirements of clause (i) or (ii) of subsection (b)(1)(A), or if a State fails to submit an application or notice before the date of expiration of the period specified in subsection (b)(1), the Administrator shall by regulation within 90 days after the date of such disapproval, determination, or expiration (as the case may be) prescribe (and may from time to time by regulation revise) a program applicable to such State meeting the requirements of section 1421(b). Such program may not include requirements which interfere with or impede—

"(1) the underground injection of brine or other fluids which are brought to the surface in connection with oil or natural gas production, or

"(2) any underground injection for the secondary or tertiary recovery of oil or natural gas,

unless such requirements are essential to assure that underground sources of drinking water will not be endangered by such injection. Such program shall apply in such State to the extent that a program adopted by such State which the Administrator determines meets such requirements is not in effect. Before promulgating any regulation under this section, the Administrator shall provide opportunity for public hearing respecting such regulation.

"(d) For purposes of this title, the term 'applicable underground injection control program' with respect to a State means the program (or most recent amendment thereof) (1) which has been adopted by the State and which has been approved under subsection (b), or (2) which has been prescribed by the Administrator under subsection (c).

"FAILURE OF STATE TO ASSURE ENFORCEMENT OF PROGRAM

"SEC. 1423. (a)(1) Whenever the Administrator finds during a period during which a State has primary enforcement responsibility for underground water sources (within the meaning of section 1422(b)(3)) that any person who is subject to a requirement of an applicable underground injection control program in such State is violating such requirement, he shall so notify the State and the person violating such requirement. If the Administrator finds such failure to comply extends beyond the thirtieth day after the date of such notice, he shall give public notice of such finding and request the State to report within 15 days after the date of such public notice as to the steps being taken to bring such person into compliance with such requirement (including reasons for anticipated steps to be taken to bring such person into compliance with such requirement and for any failure to take steps to bring such person into compliance with such requirement). If—

"(A) such failure to comply extends beyond the sixtieth day after the date of the notice given pursuant to the first sentence of this paragraph, and

"(B)(i) the State fails to submit the report requested by the Administrator within the time period prescribed by the preceding sentence, or

"(ii) the State submits such report within such period but the Administrator, after considering the report, determines that by failing to take necessary steps to bring such person into compliance by such sixtieth day the State abused its discretion in carrying out primary enforcement responsibility for underground water sources,

the Administrator may commence a civil action under subsection (b)(1).

"(2) Whenever the Administrator finds during a period during which a State does not have primary enforcement responsibility for underground water sources that any person subject to any requirement of any applicable underground injection control program in such State is violating such requirement, he may commence a civil action under subsection (b)(1).

"(b)(1) When authorized by subsection (a), the Administrator may bring a civil action under this paragraph in the appropriate United States district court to require compliance with any requirement of an applicable underground injection control program. The court may enter such judgment as protection of public health may require, including, in the case of an action brought against a person who violates an applicable requirement of an underground injection control program and who is located in a State which has primary enforcement responsibility for underground water sources, the imposition of a civil penalty of not to exceed $5,000 for each day such person violates such requirement after the expiration of 60 days after receiving notice under subsection (a)(1).

"(2) Any person who violates any requirement of an applicable underground injection control program to which he is subject during any period for which the State does not have primary enforcement responsibility for underground water sources (A) shall be subject to a civil penalty of not more than $5,000 for each day of such violation, or (B) if such violation is willful, such person may, in lieu of the civil penalty authorized by clause (B), be fined not more than $10,000 for each day of such violation.

"(c) Nothing in this title shall diminish any authority of a State or political subdivision to adopt or enforce any law or regulation respecting underground injection but no such law or regulation shall relieve any person of any requirement otherwise applicable under this title.

"INTERIM REGULATION OF UNDERGROUND INJECTIONS

"SEC. 1424. (a)(1) Any person may petition the Administrator to have an area of a State (or States) designated as an area in which no new underground injection well may be operated during the period beginning on the date of the designation and ending on the date on which the applicable underground injection control program covering such area takes effect unless a permit for the operation of such well has been issued by the Administrator under subsection (b). The Administrator may so designate an area within a State if he finds that the area has one aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health.

"(2) Upon receipt of a petition under paragraph (1) of this subsection, the Administrator shall publish it in the Federal Register and shall provide an opportunity to interested persons to submit written data, views, or arguments thereon. Not later than the 30th day following the date of the publication of a petition under this paragraph in the Federal Register, the Administrator shall either make the designation for which the petition is submitted or deny the petition.

"(b)(1) During the period beginning on the date an area is designated under subsection (a) and ending on the date the applicable underground injection control program covering such area takes effect, no new underground injection well may be operated in such area unless the Administrator has issued a permit for such operation.

"(2) Any person may petition the Administrator for the issuance of a permit for the operation of such a well in such an area. A petition submitted under this paragraph shall be submitted in such manner and contain such information as the Administrator may require by regulation. Upon receipt of such a petition, the Administrator shall publish it in the Federal Register. The Administrator shall give notice of any proceeding on a petition and shall provide opportunity for agency hearing. The Administrator shall act upon such petition on the record of any hearing held pursuant to the preceding sentence respecting such petition. Within 120 days of the publication in the Federal Register of a petition submitted under this paragraph, the Administrator shall either issue the permit for which the petition was submitted or shall deny its issuance.

"(3) The Administrator may issue a permit for the operation of a new underground injection well in an area designated under subsection (a) only if he finds that the operation of such well will not cause contamination of the aquifer of such area so as to create a significant hazard to public health. The Administrator may condition the issuance of such a permit upon the use of such control measures in connection with the operation of such well, for which the permit is to be issued, as he deems necessary to assure that the operation of the well will not contaminate the aquifer of the designated area in which the well is located so as to create a significant hazard to public health.

"(c) Any person who operates a new underground injection well in violation of subsection (b)(1) shall be subject to a civil penalty of not more than $5,000 for each day in which such violation occurs, or (2) if such violation is willful, such person may, in lieu of the civil penalty authorized by clause (1), be fined not more than $10,000 for each day in which such violation occurs. If the Administrator has reason to believe that any person is violating or will violate subsection (b), he may petition the United States district court to issue a temporary restraining order or injunction (including a mandatory injunction) to enforce such subsection.

"(d) For purposes of this section, the term 'new underground injection well' means an underground injection well whose operation was not approved by appropriate State and Federal agencies before the date of the enactment of this title.

"(e) If the Administrator determines, on his own initiative or upon petition, that an area has an acquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of that determination in the Federal Register. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such acquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the acquifer.

"PART D—EMERGENCY POWERS

"EMERGENCY POWERS

"SEC. 1431. (a) Notwithstanding any other provision of this title, the Administrator, upon receipt of information that a contaminant which is present in or is likely to enter a public water system may present an imminent and substantial endangerment to the health of persons, and that appropriate State and local authorities have not acted to protect the health of such persons, may take such actions as he may deem necessary in order to protect the health of such persons. To the extent he determines it to be practicable in light of such imminent endangerment, he shall consult with the State and local authorities in order to confirm the correctness of the information on which action

proposed to be taken under this subsection is based and to ascertain the action which such authorities are or will be taking. The action which the Administrator may take may include (but shall not be limited to) (1) issuing such orders as may be necessary to protect the health of persons who are or may be users of such system (including travelers), and (2) commencing a civil action for appropriate relief, including a restraining order or permanent or temporary injunction.

"(b) Any person who willfully violates or fails or refuses to comply with any order issued by the Administrator under subsection (a)(1) may, in an action brought in the appropriate United States district court to enforce such order, be fined not more than $5,000 for each day in which such violation occurs or failure to comply continues.

"PART E—GENERAL PROVISIONS

"ASSURANCE OF AVAILABILITY OF ADEQUATE SUPPLIES OF CHEMICALS NECESSARY FOR TREATMENT OF WATER

"SEC. 1441. (a) If any person who uses chlorine, activated carbon, lime, ammonia, soda ash, potassium permanganate, caustic soda, or other chemical or substance for the purpose of treating water in any public water system or in any public treatment works determines that the amount of such chemical or substance necessary to effectively treat such water is not reasonably available to him or will not be so available to him when required for the effective treatment of such water, such person may apply to the Administrator for a certification (hereinafter in this section referred to as a 'certification of need') that the amount of such chemical or substance which such person requires to effectively treat such water is not reasonably available to him or will not be so available when required for the effective treatment of such water.

"(b)(1) An application for a certification of need shall be in such form and submitted in such manner as the Administrator may require and shall (A) specify the persons the applicant determines are able to provide the chemical or substance with respect to which the application is submitted, (B) specify the persons from whom the applicant has sought such chemical or substance, and (C) contain such other information as the Administrator may require.

"(2) Upon receipt of an application under this section, the Administrator shall (A) publish in the Federal Register a notice of the receipt of the application and a brief summary of it, (B) notify in writing each person whom the President or his delegate (after consultation with the Administrator) determines could be made subject to an order required to be issued upon the issuance of the certification of need applied for in such application, and (C) provide an opportunity for the submission of written comments on such application. The requirements of the preceding sentence of this paragraph shall not apply when the Administrator for good cause finds (and incorporates the finding with a brief statement of reasons therefor in the order issued) that waiver of such requirements is necessary in order to protect the public health.

"(3) Within 30 days after—

"(A) the date a notice is published under paragraph (2) in the Federal Register with respect to an application submitted under this section for the issuance of a certification of need, or

"(B) the date on which such application is received if as authorized by the second sentence of such paragraph no notice is published with respect to such application,

the Administrator shall take action either to issue or deny the issuance of a certification of need.

"(c)(1) If the Administrator finds that the amount of a chemical or substance necessary for an applicant under an application submitted under this section to effectively treat water in a public water system or in a public treatment works is not reasonably available to the applicant or will not be so available to him when required for the effective treatment of such water, the Administrator shall issue a certification of need. Not later than seven days following the issuance of such certification, the President or his delegate shall issue an order requiring the provision to such person of such amounts of such chemical or substance as the Administrator deems necessary in the certification of need issued for such person. Such order shall apply to such manufacturers, producers, processors, distributors, and repackagers of such chemical or substance as the President or his delegate deems necessary and appropriate, except that such order may not apply to any manufacturer, producer, or processor of such chemical or substance who manufactures, produces, or processes (as the case may be) such chemical or substance solely for its own use. Persons subject to an order issued under this section shall be given a reasonable opportunity to consult with the President or his delegate with respect to the implementation of the order.

"(2) Orders which are to be issued under paragraph (1) to manufacturers, producers, and processors of a chemical or substance shall be equitably apportioned, as far as practicable, among all manufacturers, producers, and processors of such chemical or substance; and orders which are to be issued under paragraph (1) to distributors and repackagers of a chemical or substance shall be equitably apportioned, as far as practicable, among all distributors and repackagers of such chemical or substance. In apportioning orders issued under paragraph (1) to manufacturers, producers, processors, distributors, and repackagers of chlorine, the President or his delegate shall, in carrying out the requirements of the preceding sentence, consider—

"(A) the geographical relationships and established commercial relationships between such manufacturers, producers, processors, distributors, and repackagers and the persons for whom the orders are issued;

"(B) in the case of orders to be issued to producers of chlorine, the (i) amount of chlorine historically supplied by each such producer to treat water in public water systems and public treatment works, and (ii) share of each such producer of the total annual production of chlorine in the United States; and

"(C) such other factors as the President or his delegate may determine are relevant to the apportionment of orders in accordance with the requirements of the preceding sentence.

"(3) Subject to subsection (f), any person for whom a certification of need has been issued under this subsection may upon the expiration of the order issued under paragraph (1) upon such certification apply under this section for additional certifications.

"(d) There shall be available as a defense to any action brought for breach of contract in a Federal or State court arising out of delay or failure to provide, sell, or offer for sale or exchange a chemical or substance subject to an order issued pursuant to subsection (c)(1), that such delay or failure was caused solely by compliance with such order.

"(e)(1) Whoever knowingly fails to comply with any order issued pursuant to subsection (c)(1) shall be fined not more than $5,000 for each such failure to comply.

"(2) Whoever fails to comply with any order issued pursuant to subsection (c)(1) shall be subject to a civil penalty of not more than $2,500 for each such failure to comply.

"(3) Whenever the Administrator or the President or his delegate has reason to believe that any person is violating or will violate any order issued pursuant to subsection (c)(1), he may petition a United States district court to issue a temporary restraining order or preliminary or permanent injunction (including a mandatory injunction) to enforce the provision of such order.

"(f) No certification of need or order issued under this section may remain in effect—

"(1) for more than one year, or

"(2) after June 30, 1977, whichever occurs first.

"RESEARCH, TECHNICAL ASSISTANCE, INFORMATION TRAINING OF PERSONNEL

"SEC. 1442. (a)(1) The Administrator may conduct research, studies, and demonstrations relating to the causes, diagnosis, treatment, control, and prevention of physical and mental diseases and other impairments of man resulting directly or indirectly from contaminants in water, or to the provision of a dependably safe supply of drinking water, including—

"(A) improved methods (i) to identify and measure the existence of contaminants in drinking water (including methods which may be used by State and local health and water officials), and (ii) to identify the source of such contaminants;

"(B) improved methods to identify and measure the health effects of contaminants in drinking water;

"(C) new methods of treating raw water to prepare it for drinking, so as to improve the efficiency of water treatment and to remove contaminants from water;

"(D) improved methods for providing a dependably safe supply of drinking water, including improvements in water purification and distribution, and methods of assessing the health related hazards of drinking water; and

"(E) improved methods of protecting underground water sources of public water systems from contamination.

"(2) The Administrator shall, to the maximum extent feasible, provide technical assistance to the States and municipalities in the establishment and administration of public water system supervision programs (as defined in section 1443(c)(1)).

"(3) The Administrator shall conduct studies, and make periodic reports to Congress, on the costs of carrying out regulations prescribed under section 1412.

"(4) The Administrator shall conduct a survey and study of—

"(A) disposal of waste (including residential waste) which may endanger underground water which supplies, or can reasonably be expected to supply, any public water systems, and

"(B) means of control of such waste disposal. Not later than one year after the date of enactment of this title, he shall transmit to the Congress the results of such survey and study, together with such recommendations as he deems appropriate.

"(5) The Administrator shall carry out a study of methods of underground injection which do not result in the degradation of underground drinking water sources.

"(6) The Administrator shall carry out a study of methods of preventing, detecting, and dealing with surface spills of contaminants which may degrade underground water sources for public water systems.

"(7) The Administrator shall carry out a study of virus contamination of drinking water sources and means of control of such contamination.

"(8) The Administrator shall carry out a study of the nature and extent of the impact on underground water which supplies or can reasonably be expected to supply public water systems of (A) abandoned injection

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or extraction wells; (B) intensive application of pesticides and fertilizers in underground water recharge areas; and (C) ponds, pools, lagoons, pits, or other surface disposal of contaminants in underground water recharge areas.

"(9) The Administrator shall conduct a comprehensive study of public water supplies and drinking water sources to determine the nature, extent, sources of and means of control of contamination by chemicals or other substances suspected of being carcinogenic. Not later than six months after the date of enactment of this title, he shall transmit to the Congress the initial results of such study, together with such recommendations for further review and corrective action as he deems appropriate.

"(b) In carrying out this title, the Administrator is authorized to—

"(1) collect and make available information pertaining to research, investigations, and demonstrations with respect to providing a dependably safe supply of drinking water together with appropriate recommendations in connection therewith;

"(2) make available research facilities of the Agency to appropriate public authorities, institutions, and individuals engaged in studies and research relating to the purposes of this title;

"(3) make grants to, and enter into contracts with, any public agency, educational institution, and any other organization, in acordance with procedures prescribed by the Administrator, under which he may pay all or a part of the costs (as may be determined by the Administrator) of any project or activity which is designed—

"(A) to develop, expand, or carry out a program (which may combine training education and employment) for training persons for occupations involving the public health aspects of providing safe drinking water;

"(B) to train inspectors and supervisory personnel to train or supervise persons in occupations involving the public health aspects of providing safe drinking water; or

"(C) to develop and expand the capability of programs of States and municipalities to carry out the purposes of this title (other than by carrying out State programs of public water system supervision or underground water source protection (as defined in section 1443(d))).

"(c) There are authorized to be appropriated to carry out the provisions of this section $15,000,000 for the fiscal year ending June 30, 1975; $25,000,000 for the fiscal year ending June 30, 1976; and $35,000,000 for the fiscal year ending June 30, 1977.

"GRANTS FOR STATE PROGRAMS

"SEC. 1443. (a)(1) For allotments made pursuant to paragraph (4), the Administrator may make grants to States to carry out public water system supervision programs.

"(2) No grant may be made under paragraph (1) unless an application therefor has been submitted to the Administrator in such form and manner as he may require. The Administrator may not approve an application of a State for its first grant under paragraph (1) unless he determines that the State—

"(A) has established or will establish within one year from the date of such grant a public water system supervision program, and

"(B) will, within that one year, assume primary enforcement responsibility for public water systems within the State.

No grant may be made to a State under paragraph (1) for any period beginning more than one year after the date of the State's first grant unless the State has assumed and maintains primary enforcement responsibility for public water systems within the State.

No State shall receive less than 1 per centum of the annual appropriation for grants under paragraph (1): *Provided*, That the Administrator may, by regulation, reduce such percentage in accordance with the criteria specified in this paragraph: *And provided further*, That such percentage shall not apply to grants allotted to Guam, American Samoa, or the Virgin Islands.

"(3) A grant under paragraph (1) shall be made to cover not more than 75 per centum of the grant recipient's costs (as determined under regulations of the Administrator) in carrying out, during the one-year period beginning on the date the grant is made, a public water system supervision program.

"(4) In each fiscal year the Administrator shall, in accordance with regulations, allot the sums appropriated for such year under paragraph (5) among the States on the basis of population, geographical area, number of public water systems, and other relevant factors. To the extent the applicable appropriation permits, the allotment of a State for any fiscal year shall not be less than $50,000.

"(5) For purposes of making grants under paragraph (1) there are authorized to be appropriated $15,000,000 for the fiscal year ending June 30, 1976, and $25,000,000 for the fiscal year ending June 30, 1977.

"(b)(1) From allotments made pursuant to paragraph (4), the Administrator may make grants to States to carry out underground water source protection programs.

"(2) No grant may be made under paragraph (1) unless an application therefor has been submitted to the Administrator in such form and manner as he may require. The Administrator may not approve an application of a State for its first grant under paragraph (1) unless he determines that the State—

"(A) has established or will establish within two years from the date of such grant an underground water source protection, and

"(B) will, within such two years, assume primary enforcement responsibility for underground water sources within the State.

No grant may be made to a State under paragraph (1) for any period beginning more than two years after the date of the State's first grant unless the State has assumed and maintains primary enforcement responsibility for underground water sources within the State.

"(3) A grant under paragraph (1) shall be made to cover not more than 75 per centum of the grant recipient's costs (as determined under regulations of the Administrator) in carrying out, during the one-year period beginning on the date the grant is made, an underground water source protection program.

"(4) In each fiscal year the Administrator shall, in accordance with regulations, allot the sums appropriated for such year under paragraph (5) among the States on the basis of population, geographical area, and other relevant factors.

"(5) For purposes of making grants under paragraph (1) there are authorized to be appropriated $5,000,000 for the fiscal year ending June 30, 1976, and $7,500,000 for the fiscal year ending June 30, 1977.

"(c) For purposes of this section:

"(1) The term 'public water system supervision program' means a program for the adoption and enforcement of drinking water regulations (with such variances and exemptions from such regulations under conditions and in a manner which is not less stringent than the conditions under, and the manner in, which variances and exemptions may be granted under sections 1415 and 1416) which are no less stringent than the national primary drinking water regulations under section 1412, and for keeping records and making reports required by section 1413(a)(3).

"(2) The term 'underground water source protection program' means a program for the adoption and enforcement of a program which meets the requirements of regulations under section 1421 and for keeping records and making reports required by section 1422(b)(1)(A)(ii).

"SPECIAL STUDY AND DEMONSTRATION PROJECT GRANTS; GUARANTEED LOANS

"SEC. 1444. (a) The Administrator may make grants to any person for the purposes of—

"(1) assisting in the development and demonstration (including construction) of any project which will demonstrate a new or improved method, approach, or technology for providing a dependably safe supply of drinking water to the public; and

"(2) assisting in the development and demonstration (including construction) of any project which will investigate and demonstrate health implications involved in the reclamation, recycling, and reuse of waste waters for drinking and the processes and methods for the preparation of safe and acceptable drinking water.

"(b) Grants made by the Administrator under this section shall be subject to the following limitations:

"(1) Grants under this section shall not exceed 66⅔ per centum of the total cost of construction of any facility and 75 per centum of any other costs, as determined by the Administrator.

"(2) Grants under this section shall not be made for any project involving the construction or modification of any facilities for any public water system in a State unless such project has been approved by the State agency charged with the responsibility for safety of drinking water (or if there is no such agency in a State, by the State health authority).

"(3) Grants under this section shall not be made for any project unless the Administrator determines, after consulting the National Drinking Water Advisory Council, that such project will serve a useful purpose relating to the development and demonstration of new or improved techniques, methods, or technologies for the provision of safe water to the public for drinking.

"(4) Priority for grants under this section shall be given where there are known or potential public health hazards which require advanced technology for the removal of particles which are too small to be removed by ordinary treatment technology.

"(c) For the purposes of making grants under subsections (a) and (b) of this section there are authorized to be appropriated $7,500,000 for the fiscal year ending June 30, 1975; and $7,500,000 for the fiscal year ending June 30, 1976; and $10,000,000 for the fiscal year ending June 30, 1977.

"(d) The Administrator during the fiscal years ending June 30, 1975, and June 30, 1976, shall carry out a program of guaranteeing loans made by private lenders to small public water systems for the purpose of enabling such systems to meet national primary drinking water regulations (including interim regulations) prescribed under section 1412. No such guarantee may be made with respect to a system unless (1) such system cannot reasonably obtain financial assistance necessary to comply with such regulations from any other source, and (2) the Administrator determines that any facilities constructed with a loan guaranteed under this subsection is not likely to be made obsolete by subsequent changes in primary regulations. The aggregate amount of indebtedness guaranteed with respect to any system may not exceed $50,000. The aggregate amount of indebtedness guaranteed under this subsection may not exceed $50,000,000. The Administrator shall prescribe regulations to carry out this subsection.

"RECORDS AND INSPECTIONS

"SEC. 1445. (a) Every person who is a supplier of water, who is or may be otherwise subject to a primary drinking water regulation prescribed under section 1412 or to an

applicable underground injection control program (as defined in section 1422(c)), who is or may be subject to the permit requirement of section 1424 or to an order issued under section 1441, or who is a grantee, shall establish and maintain such records, make such reports, conduct such monitoring, and provide such information as the Administrator may reasonably require by regulation to assist him in establishing regulations under this title, in determining whether such person has acted or is acting in compliance with this title, or in administering any program of financial assistance under this title.

"(b)(1) Except as provided in paragraph (2), the Administrator, or representatives of the Administrator duly designated by him, upon presenting appropriate credentials and a written notice to any supplier of water or other person subject to a national primary drinking water regulation prescribed under section 1412 or applicable underground injection control program (or person in charge of any of the property of such supplier or other person), is authorized to enter any establishment, facility, or other property of such supplier or other person in order to determine whether such supplier or other person has acted or is acting in compliance with this title, including for this purpose, inspection, at reasonable times, of records, files, papers, processes, controls, and facilities, or in order to test any feature of a public water system, including its raw water source. The Administrator or the Comptroller General (or any representative designated by either) shall have access for the purpose of audit and examination to any records, reports, or information of a grantee which are required to be maintained under subsection (a) or which are pertinent to any financial assistance under this title.

"(2) No entry may be made under the first sentence of paragraph (1) in an establishment, facility, or other property of a supplier of water or other person subject to a national primary drinking water regulation if the establishment, facility, or other property is located in a State which has primary enforcement responsibility for public water systems unless, before written notice of such entry is made, the Administrator (or his representative) notifies the State agency charged with responsibility for safe drinking water of the reasons for such entry. The Administrator shall, upon a showing by the State agency that such an entry will be detrimental to the administration of the State's program of primary enforcement responsibility, take such showing into consideration in determining whether to make such entry. No State agency which receives notice under this paragraph of an entry proposed to be made under paragraph (1) may use the information contained in the notice to inform the person whose property is proposed to be entered of the proposed entry; and if a State agency so uses such information, notice to the agency under this paragraph is not required until such time as the Administrator determines the agency has provided him satisfactory assurances that it will no longer so use information contained in a notice under this paragraph.

"(c) Whoever fails or refuses to comply with any requirement of subsection (a) or to allow the Administrator, the Comptroller General, or representatives of either, to enter and conduct any audit or inspection authorized by subsection (b) may be fined not more than $5,000.

"(d)(1) Subject to paragraph (2), upon a showing satisfactory to the Administrator by any person that any information required under this section from such person, if made public, would divulge trade secrets or secret processes of such person, the Administrator shall consider such information confidential in accordance with the purposes of section 1905 of title 18 of the United States Code. If the applicant fails to make a showing satisfactory to the Administrator, the Administrator shall give such applicant thirty days' notice before releasing the information to which the application relates (unless the public health or safety requires an earlier release of such information).

"(2) Any information required under this section (A) may be disclosed to other officers, employees, or authorized representatives of the United States concerned with carrying out this title or to committees of the Congress, or when relevant in any proceeding under this title, and (B) shall be disclosed to the extent it deals with the level of contaminants in drinking water. For purposes of this subsection the term 'information required under this section' means any papers, books, documents, or information, or any particular part thereof, reported to or otherwise obtained by the Administrator under this section.

"(e) For purposes of this section, (1) the term 'grantee' means any person who applies for or receives financial assistance, by grant, contract, or loan guarantee under this title, and (2) the term 'person' includes a Federal agency.

"NATIONAL DRINKING WATER ADVISORY COUNCIL

"SEC. 1446. (a)(1) There is established a National Drinking Water Advisory Council which shall consist of fifteen members appointed by the Administrator after consultation with the Secretary. Five members shall be appointed from the general public; five members shall be appointed from appropriate State and local agencies concerned with water hygiene and public water supply; and five members shall be appointed from representatives of private organizations or groups demonstrating an active interest in the field of water hygiene and public water supply. Each member of the Council shall hold office for a term of three years, except that—

"(1) any member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed for the remainder of such term; and

"(2) the terms of the members first taking office shall expire as follows: Five shall expire three years after the date of enactment of this title, five shall expire two years after such date, and five shall expire one year after such date, as designated by the Administrator at the time of appointment.

The members of the Council shall be eligible for reappointment.

"(b) The Council shall advise, consult with, and make recommendations to, the Administrator on matters relating to activities, functions, and policies of the Agency under this title.

"(c) Members of the Council appointed under this section shall, while attending meetings or conferences of the Council or otherwise engaged in business of the Council, receive compensation and allowances at a rate to be fixed by the Administrator, but not exceeding the daily equivalent of the annual rate of basic pay in effect for grade GS-18 of the General Schedule for each day (including traveltime) during which they are engaged in the actual performance of duties vested in the Council. While away from their homes or regular places of business in the performance of services for the Council, members of the Council shall be allowed travel expenses, including per diem in lieu of subsistence, in the same manner as persons employed intermittently in the Government service are allowed expenses under section 5703(b) of title 5 of the United States Code.

"(d) Section 14(a) of the Federal Advisory Committee Act (relating to termination) shall not apply to the Council.

"FEDERAL AGENCIES

"SEC. 1447. (a) Each Federal agency having jurisdiction over any federally owned or maintained public water system shall comply with all national primary drinking water regulations in effect under section 1412, and each Federal agency shall comply with any applicable underground injection control program, and shall keep such records and submit such reports as may be required under such program.

"(b) The Administrator shall waive compliance with subsection (a) upon request of the Secretary of Defense and upon a determination by the President that the requested waiver is necessary in the interest of national security. The Administrator shall maintain a written record of the basis upon which such waiver was granted and make such record available for in camera examination when relevant in a judicial proceeding under this title. Upon the issuance of such a waiver, the Administrator shall publish in the Federal Register a notice that the waiver was granted for national security purposes, unless, upon the request of the Secretary of Defense, the Administrator determines to omit such publication because the publication itself would be contrary to the interests of national security, in which event the Administrator shall submit notice to the Armed Services Committee of the Senate and House of Representatives.

"JUDICIAL REVIEW

"SEC. 1448. (a) A petition for review of—

"(1) action of the Administrator in promulgating any national primary drinking water regulation under section 1412, any regulation under section 1413(b)(1), any regulation under section 1414(c), any regulation for State underground injection control programs under section 1421, or any general regulation for the administration of this title may be filed only in the United States Court of Appeals for the District of Columbia Circuit; and

"(2) action of the Administrator in promulgating any other regulation under this title, issuing any order under this title, or making any determination under this title may be filed only in the United States court of appeals for the appropriate circuit.

Any such petition shall be filed within the 45-day period beginning on the date of the promulgation of the regulation or issuance of the order with respect to which review is sought or on the date of the determination with respect to which review is sought, and may be filed after the expiration of such 45-day period if the petition is based solely on grounds arising after the expiration of such period. Action of the Administrator with respect to which review could have been obtained under this subsection shall not be subject to judicial review in any civil or criminal proceeding for enforcement or in any civil action to enjoin enforcement.

"(b) The United States district courts shall have jurisdiction of actions brought to review (1) the granting of, or the refusing to grant, a variance or exemption under section 1415 or 1416 or (2) the requirements of any schedule prescribed for a variance or exemption under such section or the failure to prescribe such a schedule. Such an action may only be brought upon a petition for review filed with the court within the 45-day period beginning on the date the action sought to be reviewed is taken or, in the case of a petition to review the refusal to grant a variance or exemption or the failure to prescribe a schedule, within the 45-day period beginning on the date action is required to be taken on the variance, exemption, or schedule, as the case may be. A petition for such review may be filed after the expiration of such period if the petition is based solely on grounds arising after the expiration of such period. Action with respect to which review could have been obtained under this subsection shall not be subject to judicial review in any civil or criminal proceeding for enforcement or in any civil action to enjoin enforcement.

"(c) In any judicial proceeding in which

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review is sought of a determination under this title required to be made on the record after notitce and opportunity for hearing, if any party applies to the court for leave to adduce additional evidence and shows to the satisfaction of the court that such additional evidence is material and that there were reasonable grounds for the failure to adduce such evidence in the proceeding before the Administrator, the court may order such additional evidence (and evidence in rebuttal thereof) to be taken before the Administrator, in such manner and upon such terms and conditions as to the court may deem proper. The Administrator may modify his findings as to the facts, or make new findings, by reason of the additional evidence so taken, and he shall file such modified or new findings, and his recommendation, if any, for the modification or setting aside of his original determination, with the return of such addtional evidence.

"CITIZEN'S CIVIL ACTION

"SEC. 1449. (a) Except as provided in subsection (b) of this section, any person may commence a civil action on his own behalf—

"(1) against any person (including (A) the United States, and (B) any other governmental instrumentality or agency to the extent permitted by the eleventh amendment to the Constitution) who is alleged to be in violation of any requirement prescribed by or under this title, or

"(2) against the Administrator where there is alleged a failure of the Administrator to perform any act or duty under this title which is not discretionary with the Administrator.

No action may be brought under paragraph (1) against a public water system for a violation of a requirement prescribed by or under this title which occurred within the 27-month period beginning on the first day of the month in which this title is enacted. The United States district courts shall have jurisdiction, without regard to the amount in controversy or the citizenship of the parties, to enforce in an action brought under this subsection any requirement prescribed by or under this title or to order the Administrator to perform an act or duty described in paragraph (2), as the case may be.

"(b) No civil action may be commenced—

"(1) under subsection (a)(1) of this section respecting violation of a requirement prescribed by or under this title—

"(A) prior to sixty days after the plaintiff has given notice of such violation (i) to the Administrator, (ii) to any alleged violator of such requirement and (iii) to the State in which the violation occurs, or

"(B) if the Administrator, the Attorney General, or the State has commenced and is diligently prosecuting a civil action in a court of the United States to require compliance with such requirement, but in any such action in a court of the United States any person may intervene as a matter of right; or

"(2) under subsection (a)(2) of this section prior to sixty days after the plaintiff has given notice of such action to the Administrator.

Notice required by this subsection shall be given in such manner as the Administrator shall prescribe by regulation.

"(c) In any action under this section, the Administrator or the Attorney General, if not a party, may intervene as a matter of right.

No person may commence a civil action under subsection 1415 or 1416 for a variance or exemption, unless such person shows to the satisfaction of the court that the State has in a substantial number of cases failed to prescribe such schedules.

"(d) The court, in issuing any final order in any action brought under subsection (a) of this section, may award costs of litigation (including reasonable attorney and expert witness fees) to any party whenever the court determines such an award is appropriate. The court may, if a temporary restraining order or preliminary injunction is sought, require the filing of a bond or equivalent security in accordance with the Federal Rules of Civil Procedure.

"(e) Nothing in this section shall restrict any right which any person (or class of persons) may have under any statute or common law to seek enforcement of any requirement prescribed by or under this title or to seek any other relief.

"GENERAL PROVISIONS

"SEC. 1450. (a)(1) The Administrator is authorized to prescribe such regulations as are necessary or appropriate to carry out his functions under this title.

"(2) The Administrator may delegate any of his functions under this title (other than prescribing regulations) to any officer or employee of the Agency.

"(b) The Administrator, with the consent of the head of any other agency of the United States, may utilize such officers and employees of such agency as he deems necessary to assist him in carrying out the purposes of this title.

"(c) Upon the request of a State or interstate agency, the Administrator may assign personnel of the Agency to such State or interstate agency for the purposes of carrying out the provisions of this title.

"(d)(1) The Administrator may make payments of grants under this title (after necessary adjustment on account of previously made underpayments or overpayments) in advance or by way of reimbursement, and in such installments and on such conditions as he may determine.

"(2) Financial assistance may be made available in the form of grants only to individuals and nonprofit agencies or institutions. For purposes of this paragraph, the term 'nonprofit agency or institution' means an agency or institution no part of the net earnings of which inure, or may lawfully inure, to the benefit of any private shareholder or individual.

"(e) The Administrator shall take such action as may be necessary to assure compliance with provisions of the Act of March 3, 1931 (known as the Davis-Bacon Act; 40 U.S.C. 276a–276a(5)). The Secretary of Labor shall have, with respect to the labor standards specified in this subsection, the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (15 F.R. 3176; 64 Stat. 1267) and section 2 of the Act of June 13, 1934 (40 U.S.C. 276c).

"(f) The Administrator shall request the Attorney General to appear and represent him in any civil action instituted under this title to which the Administrator is a party. Unless, within a reasonable time, the Attorney General notifies the Administrator that he will apear in such action, attorneys appointed by the Administrator shall appear and represent him.

"(g) The provisions of this title shall not be construed as affecting any authority of the Administrator under part G of title III of this Act.

"(h) Not later than April 1 of each year; the Administrator shall submit to the Committee on Commerce of the Senate and the Committee on Interstate and Foreign Commerce of the House of Representatives a report respecting the activities of the Agency under this title and containing such recommendations for legislation as he considers necessary. The report of the Administrator under this subsection which is due not later than April 1, 1975, and each subsequent report of the Administrator under this subsection shall include a statement on the actual anticipated cost to public water systems in each State of compliance with the requirements of this title. The Office of Management and Budget may review any report required by this subsection before its submission to such committees of Congress, but the Office may not revise any such report, require any revision in any such report, or delay its submission beyond the day prescribed for its submission, and may submit to such committees of Congress its comments respecting any such report.

"(i)(1) No employer may discharge any employee or otherwise discriminate against any employee with respect to his compensation, terms, conditions, or privileges of employment because the employee (or any person acting pursuant to a request of the employee) has—

"(A) commenced, caused to be commenced, or is about to commence or cause to be commenced a proceeding under this title or a proceeding for the administration or enforcement of drinking water regulations or underground injection control programs of a State,

"(B) testified or is about to testify in any such proceeding, or

"(C) assisted or participated or is about to assist or participate in any manner in such a proceeding or in any other action to carry out the purposes of this title. "(2)(A) Any employee who believes that he has been discharged or otherwise discriminated against by any person in violation of paragraph (1) may, within 30 days after such violation occurs, file (or have any person file on his behalf) a complaint with the Secretary of Labor (hereinafter in this subsection referred to as the 'Secretary') alleging such discharge or discrimination. Upon receipt of such a complaint, the Secretary shall notify the person named in the complaint of the filing of the complaint.

"(B)(i) Upon receipt of a complaint filed under subparagraph (A), the Secretary shall conduct an investigation of the violation alleged in the complaint. Within 30 days of the receipt of such complaint, the Secretary shall complete such investigation and shall notify in writing the complainant (and any person acting in his behalf) and the person alleged to have committed such violation of the results of the investigation conducted pursuant to this subparagraph. Within 90 days of the receipt of such complaint the Secretary shall, unless the proceeding on the complaint is terminated by the Secretary on the basis of a settlement entered into by the Secretary and the person alleged to have committed such violation, issue an order either providing the relief prescribed by clause (ii) or denying the complaint. An order of the Secretary shall be made on the record after notice and opportunity for agency hearing. The Secretary may not enter into a settlement terminating a proceeding on a complaint without the participation and consent of the complainant.

"(ii) If in response to a complaint filed under subparagraph (A) the Secretary determines that a violation of paragraph (1) has occurred, the Secretary shall order (I) the person who committed such violation to take affirmative action to abate the violation, (II) such person to reinstate the complainant to his former position together with the compensation (including back pay), terms, conditions, and privileges of his employment, (III) compensatory damages, and (IV) where appropriate, exemplary damages. If such an order is issued, the Secretary, at the request of the complainant, shall assess against the person against whom the order is issued a sum equal to the aggregate amount of all costs and expenses (including attorneys' fees) reasonably incurred, as determined by the Secretary, by the complainant for, or in connection with, the bringing of the complaint upon which the order was issued.

"(3)(A) Any person adversely affected or aggrieved by an order issued under paragraph (2) may obtain review of the order in the United States Court of Appeals for the circuit in which the violation, with respect to

which the order was issued, allegedly occurred. The petition for review must be filed within sixty days from the issuance of the Secretary's order. Review shall conform to chapter 7 of title 5 of the United States Code. The commencement of proceedings under this subparagraph shall not, unless ordered by the court, operate as a stay of the Secretary's order.

"(B) An order of the Secretary with respect to which review could have been obtained under subparagraph (A) shall not be subject to judicial review in any criminal or other civil proceeding.

"(4) Whenever a person has failed to comply with an order issued under paragraph (2)(B), the Secretary shall file a civil action in the United States District Court for the district in which the violation was found to occur to enforce such order. In actions brought under this paragraph, the district courts shall have jurisdiction to grant all appropriate relief including, but not limited to, injunctive relief, compensatory, and exemplary damages. Civil actions filed under this paragraph shall be heard and decided expeditiously.

"(5) Any nondiscretionary duty imposed by this section is enforceable in mandamus proceeding brought under section 1361 of title 28 of the United States Code.

"(6) Paragraph (1) shall not apply with respect to any employee who, acting without direction from his employer (or the employer's agent), deliberately causes a violation of any requirement of this title."

(b) Section 2(f) of the Public Health Service Act is amended by inserting "(1)" after "except that" and by inserting before the semicolon at the end thereof the following: ", and (2) as used in title XIV such term includes Guam, American Samoa, and the Trust Territory of the Pacific Islands".

RURAL WATER SURVEY

SEC. 3. (a) The Administrator of the Environmental Protection Agency shall (after consultation with the Secretary of Agriculture and the several States) enter into arrangements with public or private entities as may be appropriate to conduct a survey of the quantity, quality, and availability of rural drinking water supplies. Such survey shall include, but not be limited to, the consideration of the number of residents in each rural area—

(1) presently being inadequately served by a public or private drinking water supply system, or by an individual home drinking water supply system;

(2) presently having limited or otherwise inadequate access to drinking water;

(3) who, due to the absence or inadequacy of a drinking water supply system, are exposed to an increased health hazard; and

(4) who have experienced incidents of chronic or acute illness, which may be attributed to the absence or inadequacy of a drinking water supply system.

(b) Such survey shall be completed within eighteen months of the date of enactment of this Act and a final report thereon submitted, not later than six months after the completion of such survey, to the President for transmittal to the Congress. Such report shall include recommendations for improving rural water supplies.

(c) There are authorized to be appropriated to carry out the provisions of this section $1,000,000 for the fiscal year ending June 30, 1975; $2,000,000 for the fiscal year ending June 30, 1976; and $1,000,000 for the fiscal year ending June 30, 1977.

BOTTLED DRINKING WATER

SEC. 4. Chapter IV of the Federal Food, Drug, and Cosmetic Act is amended by adding after section 409 the following new section:

"BOTTLED DRINKING WATER STANDARDS

"SEC. 410. Whenever the Administrator of the Environmental Protection Agency prescribes interim or revised national primary drinking water regulations under section 1412 of the Public Health Service Act, the Secretary shall consult with the Administrator and within 180 days after the promulgation of such drinking water regulations either promulgate amendments to regulations under this chapter applicable to bottled drinking water or publish in the Federal Register his reasons for not making such amendments.".

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FEDERAL WATER POLLUTION CONTROL ACT

(33 U.S.C. 1251, *et seq.*, PL 92-500; Enacted by Congress October 18, 1972, Overriding the President's Veto of October 17, 1972, as amended by PL 93-207, December 28, 1973, and PL 93-243, January 2, 1974; PL 93-592, January 2, 1975; PL 94-238, March 23, 1976; PL 94-558, October 19, 1976)

[*Editor's note:* The Federal Water Pollution Control Act Amendments of 1972, PL 92-500, replaced the previous language of the Act entirely, including the Water Quality Act of 1965, the Clean Water Restoration Act of 1966, and the Water Quality Improvement Act of 1970, all of which had been amendments of the Federal Water Pollution Control Act first passed in 1956.]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Federal Water Pollution Control Act Amendments of 1972".

SEC. 2. The Federal Water Pollution Control Act is amended to read as follows:

"TITLE I—RESEARCH AND RELATED PROGRAMS

"DECLARATION OF GOALS AND POLICY

"SEC. 101. (a) The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In order to achieve this objective it is hereby declared that, consistent with the provisions of this Act—

"(1) it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985;

"(2) it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983;

"(3) it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited;

"(4) it is the national policy that Federal financial assistance be provided to construct publicly owned waste treatment works;

"(5) it is the national policy that areawide waste treatment management planning processes be developed and implemented to assure adequate control of sources of pollutants in each State; and

"(6) it is the national policy that a major research and demonstration effort be made to develop technology necessary to eliminate the discharge of pollutants into the navigable waters, waters of the contiguous zone, and the oceans.

"(b) It is the policy of the Congress to recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, to plan the development and use (including restoration, preservation, and enhancement) of land and water resources, and to consult with the Administrator in the exercise of his authority under this Act. It is further the policy of the Congress to support and aid research relating to the prevention, reduction, and elimination of pollution, and to provide Federal technical services and financial aid to State and interstate agencies and municipalities in connection with the prevention, reduction, and elimination of pollution.

"(c) It is further the policy of Congress that the President, acting through the Secretary of State and such national and international organizations as he determines appropriate, shall take such action as may be necessary to insure that to the fullest extent possible all foreign countries shall take meaningful action for the prevention, reduction, and elimination of pollution in their waters and in international waters and for the achievement of goals regarding the elimination of discharge of pollutants and the improvement of water quality to at least the same extent as the United States does under its laws.

"(d) Except as otherwise expressly provided in this Act, the Administrator of the Environmental Protection Agency (hereinafter in this Act called 'Administrator') shall administer this Act.

"(e) Public participation in the development, revision, and enforcement of any regulation, standard, effluent limitation, plan, or program established by the Administrator or any State under this Act shall be provided for, encouraged, and assisted by the Administrator and the States. The Administrator, in cooperation with the States, shall develop and publish regulations specifying minimum guidelines for public participation in such processes.

"(f) It is the national policy that to the maximum extent possible the procedures utilized for implementing this Act shall encourage the drastic minimization of paperwork and interagency decision procedures, and the best use of available manpower and funds, so as to prevent needless duplication and unnecessary delays at all levels of government.

"COMPREHENSIVE PROGRAMS FOR WATER POLLUTION CONTROL

"SEC. 102. (a) The Administrator shall, after careful investigation, and in cooperation with other Federal agencies, State water pollution control agencies, interstate agencies, and the municipalities and industries involved, prepare or develop comprehensive programs for preventing, reducing, or eliminating the pollution of the navigable waters and ground waters and improving the sanitary condition of surface and underground waters. In the development of such comprehensive programs due regard shall be given to the improvements which are necessary to conserve such waters for the protection and propagation of fish and aquatic life and wildlife, recreational purposes, and the withdrawal of such waters for public water supply, agricultural, industrial, and other purposes. For the purpose of this section, the Administrator is authorized to make joint investigations with any such agencies of the condition of any waters in any State or States, and of the discharges of any sewage, industrial wastes, or substance which may adversely affect such waters.

"(b) (1) In the survey or planning of any reservoir by the Corps of Engineers, Bureau of Reclamation, or other Federal agency, consideration shall be given to inclusion of storage for regulation of streamflow, except that any such storage and water releases shall not be provided as a substitute for adequate treatment or other methods of controlling waste at the source.

"(2) The need for and the value of storage for regulation of streamflow (other than for water quality) including but not limited to navigation, salt water intrusion, recreation, esthetics, and fish and wildlife, shall be determined by the Corps of Engineers, Bureau of Reclamation, or other Federal agencies.

"(3) The need for, the value of, and the impact of, storage for water quality control shall be determined by the Administrator, and his views on these matters shall be set forth in any report or presentation to Congress proposing authorization or construction of any reservoir including such storage.

"(4) The value of such storage shall be taken into account in determining the economic value of the entire project of which it is a part, and costs shall be allocated to the purpose of regulation of streamflow in a manner which will insure that all project purposes, share equitably in the benefits of multiple-purpose construction.

"(5) Costs of regulation of streamflow features incorporated in any Federal reservoir or other impoundment under the provisions of this Act shall be determined and the beneficiaries identified and if the benefits are widespread or national in scope, the costs of such features shall be nonreimbursable.

"(6) No license granted by the Federal Power Commission for a hydroelectric power project shall include storage for regulation of streamflow for the purpose of water quality control unless the Administrator shall recommend its inclusion and such reservoir storage capacity shall not exceed such proportion of the total storage required for the water quality control plan as the drainage area of such reservoir bears to the drainage area of the river basin or basins involved in such water quality control plan.

"(c) (1) The Administrator shall, at the request of the Governor of a State, or a majority of the Governors when more than one State is involved, make a grant to pay not to exceed 50 per centum of the administrative expenses of a planning agency for a period not to exceed three years, which period shall begin after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, if such agency provides for adequate representation of appropriate State, interstate, local, or (when appropriate) international interests in the basin or portion thereof involved and is capable of developing an effective, comprehensive water quality control plan for a basin or portion thereof.

"(2) Each planning agency receiving a grant under this subsection shall develop a comprehensive pollution control plan for the basin or portion thereof which—

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"(A) is consistent with any applicable water quality standards, effluent and other limitations, and thermal discharge regulations established pursuant to current law within the basin;

"(B) recommends such treatment works as will provide the most effective and economical means of collection, storage, treatment, and elimination of pollutants and recommends means to encourage both municipal and industrial use of such works;

"(C) recommends maintenance and improvement of water quality within the basin or portion thereof and recommends methods of adequately financing those facilities as may be necessary to implement the plan; and

"(D) as appropriate, is developed in cooperation with, and is consistent with any comprehensive plan prepared by the Water Resources Council, any areawide waste management plans developed pursuant to section 208 of this Act, and any State plan developed pursuant to section 303(e) of this Act.

"(3) For the purposes of this subsection the term 'basin' includes, but is not limited to, rivers and their tributaries, streams, coastal waters, sounds, estuaries, bays, lakes, and portions thereof, as well as the lands drained thereby.

"INTERSTATE COOPERATION AND UNIFORM LAWS

"SEC. 103. (a) The Administrator shall encourage cooperative activities by the States for the prevention, reduction, and elimination of pollution, encourage the enactment of improved and, so far as practicable, uniform State laws relating to the prevention, reduction, and elimination of pollution; and encourage compacts between States for the prevention and control of pollution.

"(b) The consent of the Congress is hereby given to two or more States to negotiate and enter into agreements or compacts, not in conflict with any law or treaty of the United States, for (1) cooperative effort and mutual assistance for the prevention and control of pollution and the enforcement of their respective laws relating thereto, and (2) the establishment of such agencies, joint or otherwise, as they may deem desirable for making effective such agreements and compacts. No such agreement or compact shall be binding or obligatory upon any State a party thereto unless and until it has been approved by the Congress.

"RESEARCH, INVESTIGATIONS, TRAINING, AND INFORMATION

"SEC. 104. (a) The Administrator shall establish national programs for the prevention, reduction, and elimination of pollution and as part of such programs shall—

"(1) in cooperation with other Federal, State, and local agencies, conduct and promote the coordination and acceleration of, research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of pollution;

"(2) encourage, cooperate with, and render technical services to pollution control agencies and other appropriate public or private agencies, institutions, and organizations, and individuals, including the general public, in the conduct of activities referred to in paragraph (1) of this subsection;

"(3) conduct, in cooperation with State water pollution control agencies and other interested agencies, organizations and persons, public investigations concerning the pollution of any navigable waters, and report on the results of such investigations;

"(4) establish advisory committees composed of recognized experts in various aspects of pollution and representatives of the public to assist in the examination and evaluation of research progress and proposals and to avoid duplication of research;

"(5) in cooperation with the States, and their political subdivisions, and other Federal agencies establish, equip, and maintain a water quality surveillance system for the purpose of monitoring the quality of the navigable waters and ground waters and the contiguous zone and the oceans and the Administrator shall, to the extent practicable, conduct such surveillance by utilizing the resources of the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, the Geological Survey, and the Coast Guard, and shall report on such quality in the report required under subsection (a) of section 516; and

"(6) initiate and promote the coordination and acceleration of research designed to develop the most effective practicable tools and techniques for measuring the social and economic costs and benefits of activities which are subject to regulation under this Act; and shall transmit a report on the results of such research to the Congress not later than January 1, 1974.

"(b) In carrying out the provisions of subsection (a) of this section the Administrator is authorized to—

"(1) collect and make available, through publications and other appropriate means, the results of and other information, including appropriate recommendations by him in connection therewith, pertaining to such research and other activities referred to in paragraph (1) of subsection (a);

"(2) cooperate with other Federal departments and agencies, State water pollution control agencies, interstate agencies, other public and private agencies, institutions, organizations, industries involved, and individuals, in the preparation and conduct of such research and other activities referred to in paragraph (1) of subsection (a);

"(3) make grants to State water pollution control agencies, interstate agencies, other public or nonprofit private agencies, institutions, organizations, and individuals, for purposes stated in paragraph (1) of subsection (a) of this section;

"(4) contract with public or private agencies, institutions, organizations, and individuals, without regard to sections 3648 and 3709 of the Revised Statutes (31 U.S.C. 529; 41 U.S.C. 5), referred to in paragraph (1) of subsection (a);

"(5) establish and maintain research fellowships at public or nonprofit private educational institutions or research organizations;

"(6) collect and disseminate, in cooperation with other Federal departments and agencies, and with other public or private agencies, institutions, and organizations having related responsibilities, basic data on chemical, physical, and biological effects of varying water quality and other information pertaining to pollution and the prevention, reduction, and elimination thereof; and

"(7) develop effective and practical processes, methods, and prototype devices for the prevention, reduction, and elimination of pollution.

"(c) In carrying out the provisions of subsection (a) of this section the Administrator shall conduct research on, and survey the results of other scientific studies on, the harmful effects on the health or welfare of persons caused by pollutants. In order to avoid duplication of effort, the Administrator shall, to the extent practicable, conduct such research in cooperation with and through the facilities of the Secretary of Health, Education, and Welfare.

"(d) In carrying out the provisions of this section the Administrator shall develop and demonstrate under varied conditions (including conducting such basic and applied research, studies, and experiments as may be necessary):

"(1) Practicable means of treating municipal sewage, and other waterborne wastes to implement the requirements of section 201 of this Act;

"(2) Improved methods and procedures to identify and measure the effects of pollutants, including those pollutants created by new technological developments; and

"(3) Methods and procedures for evaluating the effects on water quality of augmented streamflows to control pollution not susceptible to other means of prevention, reduction, or elimination.

"(e) The Administrator shall establish, equip, and maintain field laboratory and research facilities, including, but not limited to, one to be located in the northeastern area of the United States, one in the Middle Atlantic area, one in the southeastern area, one in the midwestern area, one in the southwestern area, one in the Pacific Northwest, and one in the State of Alaska, for the conduct of research, investigations, experiments, field demonstrations and studies, and training relating to the prevention, reduction and elimination of pollution. Insofar as practicable, each such facility shall be located near institutions of higher learning in which graduate training in such research might be carried out. In conjunction with the development of criteria under section 403 of this Act, the Administrator shall construct the facilities authorized for the National Marine Water Quality Laboratory established under this subsection.

"(f) The Administrator shall conduct research and technical development work, and make studies, with respect to the quality of the waters of the Great Lakes, including an analysis of the present and projected future water quality of the Great Lakes under varying conditions of waste treatment and disposal, an evaluation of the water quality needs of those to be served by such waters, an evaluation of municipal, industrial, and vessel waste treatment and disposal practices with respect to such waters, and a study of alternate means of solving pollution problems (including additional waste treatment measures) with respect to such waters.

"(g)(1) For the purpose of providing an adequate supply of trained personnel to operate and maintain existing and future treatment works and related activities, and for the purpose of enhancing substantially the proficiency of those engaged in such activities, the Administrator shall finance pilot programs, in cooperation with State and interstate agencies, municipalities, educational institutions, and other organizations and individuals, of manpower development and training and retraining of persons in, on entering into, the field of operation and maintenance of treatment works and related activities. Such program and any funds expended for such a program shall supplement, not supplant, other manpower and training programs and funds available for the purposes of this paragraph. The Administrator is authorized, under such terms and conditions as he deems appropriate, to enter into agreements with one or more States, acting jointly or sever-

ally, or with other public or private agencies or institutions for the development and implementation of such a program.

"(2) The Administrator is authorized to enter into agreements with public and private agencies and institutions, and individuals to develop and maintain an effective system for forecasting the supply of, and demand for, various professional and other occupational categories needed for the prevention, reduction, and elimination of pollution in each region, State, or area of the United States and, from time to time, to publish the results of such forecasts.

"(3) In furtherance of the purposes of this Act, the Administrator is authorized to—

"(A) make grants to public or private agencies and institutions and to individuals for training projects, and provide for the conduct of training by contract with public or private agencies and institutions and with individuals without regard to sections 3648 and 3709 of the Revised Statutes;

"(B) establish and maintain research fellowships in the Environmental Protection Agency with such stipends and allowances, including traveling and subsistence expenses, as he may deem necessary to procure the assistance of the most promising research fellows; and

"(C) provide, in addition to the program established under paragraph (1) of this subsection, training in technical matters relating to the causes, prevention, reduction, and elimination of pollution for personnel of public agencies and other persons with suitable qualifications.

"(4) The Administrator shall submit, through the President, a report to the Congress not later than December 31, 1973, summarizing the actions taken under this subsection and the effectiveness of such actions, and setting forth the number of persons trained, the occupational categories for which training was provided, the effectiveness of other Federal, State, and local training programs in this field, together with estimates of future needs, recommendations on improving training programs, and such other information and recommendations, including legislative recommendations, as he deems appropriate.

"(h) The Administrator is authorized to enter into contracts with, or make grants to, public or private agencies and organizations and individuals for (A) the purpose of developing and demonstrating new or improved methods for the prevention, removal, reduction, and elimination of pollution in lakes, including the undesirable effects of nutrients and vegetation, and (B) the construction of publicly owned research facilities for such purpose.

"(i) The Administrator, in cooperation with the Secretary of the department in which the Coast Guard is operating, shall—

"(1) engage in such research, studies, experiments, and demonstrations as he deems appropriate, relative to the removal of oil from any waters and to the prevention, control, and elimination of oil and hazardous substances pollution;

"(2) publish from time to time the results of such activities; and

"(3) from time to time, develop and publish in the Federal Register specifications and other technical information on the various chemical compounds used in the control of oil and hazardous substances spills.

In carrying out this subsection, the Administrator may enter into contracts with, or make grants to, public or private agencies and organizations and individuals.

"(j) The Secretary of the department in which the Coast Guard is operating shall engage in such research, studies, experiments, and demonstrations as he deems appropriate relative to equipment which is to be installed on board a vessel and is designed to receive, retain, treat, or discharge human body wastes and the wastes from toilets and other receptacles intended to receive or retain body wastes with particular emphasis on equipment to be installed on small recreational vessels. The Secretary of the department in which the Coast Guard is operating shall report to Congress the results of such research, studies, experiments, and demonstrations prior to the effective date of any regulations established under section 312 of this Act. In carrying out this subsection the Secretary of the department in which the Coast Guard is operating may enter into contracts with, or make grants to, public or private organizations and individuals.

"(k) In carrying out the provisions of this section relating to the conduct by the Administrator of demonstration projects and the development of field laboratories and research facilities, the Administrator may acquire land and interests therein by purchase, with appropriated or donated funds, by donation, or by exchange for acquired or public lands under his jurisdiction which he classifies as suitable for disposition. The values of the properties so exchanged either shall be approximately equal, or if they are not approximately equal, the values shall be equalized by the payment of cash to the grantor or to the Administrator as the circumstances require.

"(l)(1) The Administrator shall, after consultation with appropriate local, State, and Federal agencies, public and private organizations, and interested individuals, as soon as practicable but not later than January 1, 1973, develop and issue to the States for the purpose of carrying out this Act the latest scientific knowledge available in indicating the kind and extent of effects on health and welfare which may be expected from the presence of pesticides in the water in varying quantities. He shall revise and add to such information whenever necessary to reflect developing scientific knowledge.

"(2) The President shall, in consultation with appropriate local, State, and Federal agencies, public and private organizations, and interested individuals, conduct studies and investigations of methods to control the release of pesticides into the environment which study shall include examination of the persistency of pesticides in the water environment and alternatives thereto. The President shall submit reports, from time to time, on such investigations to Congress together with his recommendations for any necessary legislation.

"(m)(1) The Administrator shall, in an effort to prevent degradation of the environment from the disposal of waste oil, conduct a study of (A) the generation of used engine, machine, cooling, and similar waste oil, including quantities generated, the nature and quality of such oil, present collecting methods and disposal practices, and alternate uses of such oil; (B) the long-term, chronic biological effects of the disposal of such waste oil; and (C) the potential market for such oils, including the economic and legal factors relating to the sale of products made from such oils, the level of subsidy, if any, needed to encourage the purchase by public and private nonprofit agencies of products from such oil, and the practicability of Federal procurement, on a priority basis, of products made from such oil. In conducting such study, the Administrator shall consult with affected industries and other persons.

"(2) The Administrator shall report the preliminary results of such study to Congress within six months after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, and shall submit a final report to Congress within 18 months after such date of enactment.

"(n)(1) The Administrator shall, in cooperation with the Secretary of the Army, the Secretary of Agriculture, the Water Resources Council, and with other appropriate Federal, State, interstate, or local public bodies and private organizations, institutions, and individuals, conduct and promote, and encourage contributions to, continuing comprehensive studies of the effects of pollution, including sedimentation, in the estuaries and estuarine zones of the United States on fish and wildlife, on sport and commercial fishing, on recreation, on water supply and water power, and on other beneficial purposes. Such studies shall also consider the effect of demographic trends, the exploitation of mineral resources and fossil fuels, land and industrial development, navigation, flood and erosion control, and other uses of estuaries and estuarine zones upon the pollution of the waters therein.

"(2) In conducting such studies, the Administrator shall assemble, coordinate, and organize all existing pertinent information on the Nation's estuaries and estuarine zones; carry out a program of investigations and surveys to supplement existing information in representative estuaries and estuarine zones; and identify the problems and areas where further research and study are required.

"(3) The Administrator shall submit to Congress, from time to time, reports of the studies authorized by this subsection but at least one such report during any three year period. Copies of each such report shall be made available to all interested parties, public and private.

"(4) For the purpose of this subsection, the term 'estuarine zones' means an environmental system consisting of an estuary and those transitional areas which are consistently influenced or affected by water from an estuary such as, but not limited to, salt marshes, coastal and intertidal areas, bays, harbors, lagoons, inshore waters, and channels, and the term 'estuary' means all or part of the mouth of a river or stream or other body of water having unimpaired natural connection with open sea and within which the sea water is measurably diluted with fresh water derived from land drainage.

"(o)(1) The Administrator shall conduct research and investigations on devices, systems, incentives, pricing policy, and other methods of reducing the total flow of sewage, including, but not limited to, unnecessary water consumption in order to reduce the requirements for, and the costs of, sewage and waste treatment services. Such research and investigations shall be directed to develop devices, systems, policies, and methods capable of achieving the maximum reduction of unnecessary water consumption.

"(2) The Administrator shall report the preliminary results of such studies and investigations to the Congress within one year after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, and annually thereafter in the report required under subsection (a) of section 516. Such report shall include recommendations for any legislation that may be required to provide for the adoption and use of devices, systems, policies, or other methods of reducing water consumption and reducing the total flow of sewage. Such report shall include an estimate of the benefits to be derived from adoption and use of such devices, systems, policies, or other methods and also shall reflect estimates of any increase in private, public, or other cost that would be occasioned thereby.

"(p) In carrying out the provisions of subsection (a) of this section the Administrator shall, in cooperation with the Secretary of Agriculture, other Federal agencies, and the States, carry out a compre-

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hensive study and research program to determine new and improved methods and the better application of existing methods of preventing, reducing, and eliminating pollution from agriculture, including the legal, economic, and other implications of the use of such methods.

"(q) (1) The Administrator shall conduct a comprehensive program of research and investigation and pilot project implementation into new and improved methods of preventing, reducing, storing, collecting, treating, or otherwise eliminating pollution from sewage in rural and other areas where collection of sewage in conventional, community-wide sewage collection systems is impractical, uneconomical, or otherwise infeasible, or where soil conditions or other factors preclude the use of septic tank and drainage field systems.

"(2) The Administrator shall conduct a comprehensive program of research and investigation and pilot project implementation into new and improved methods for the collection and treatment of sewage and other liquid wastes combined with the treatment and disposal of solid wastes.

"(r) The Administrator is authorized to make grants to colleges and universities to conduct basic research into the structure and function of fresh water aquatic ecosystems, and to improve understanding of the ecological characteristics necessary to the maintenance of the chemical, physical, and biological integrity of freshwater aquatic ecosystems.

"(s) The Administrator is authorized to make grants to one or more institutions of higher education (regionally located and to be designated as 'River Study Centers') for the purpose of conducting and reporting on interdisciplinary studies on the nature of river systems, including hydrology, biology, ecology, economics, the relationship between river uses and land uses, and the effects of development within river basins on river systems and on the value of water resources and water related activities. No such grant in any fiscal year shall exceed $1,000,000.

"(t) The Administrator shall, in cooperation with State and Federal agencies and public and private organizations, conduct continuing comprehensive studies of the effects and methods of control of thermal discharges. In evaluating alternative methods of control the studies shall consider (1) such data as are available on the latest available technology, economic feasibility including cost-effectiveness analysis, and (2) the total impact on the environment, considering not only water quality but also air quality, land use, and effective utilization and conservation of fresh water and other natural resources. Such studies shall consider methods of minimizing adverse effects and maximizing beneficial effects of thermal discharges. The results of these studies shall be reported by the Administrator as soon as practicable, but not later than 270 days after enactment of this subsection, and shall be made available to the public and the States, and considered as they become available by the Administrator in carrying out section 316 of this Act and by the States in proposing thermal water quality standards.

"(u) There is authorized to be appropriated (1) $100,000,000 per fiscal year for the fiscal year ending June 30, 1973, the fiscal year ending June 30, 1974, and the fiscal year ending June 30, 1975, for carrying out the provisions of this section other than subsections (g) (1) and (2), (p), (r), and (t); (2) not to exceed $7,500,000 for fiscal years 1973, 1974, and 1975 for carrying out the provisions of subsection (g) (1); (3) not to exceed $2,500,000 for fiscal years 1973, 1974, and 1975 for carrying out the provisions of subsection (g) (2); (4) not to exceed $10,000,000 for each of the fiscal years ending June 30, 1973, June 30, 1974, and June 30, 1975, for carrying out the provisions of subsection (p); (5) not to exceed $15,000,000 per fiscal year for the fiscal years ending June 30, 1973, June 30, 1974, and June 30, 1975, for carrying out the provisions of subsection (r); and (6) not to exceed $10,000,000 per fiscal year for the fiscal years ending June 30, 1973, June 30, 1974, and June 30, 1975 for carrying out the provisions of subsection (t).

"GRANTS FOR RESEARCH AND DEVELOPMENT

"SEC. 105. (a) The Administrator is authorized to conduct in the Environmental Protection Agency, and to make grants to any State, municipality, or intermunicipal or interstate agency for the purpose of assisting in the development of—

"(1) any project which will demonstrate a new or improved method of preventing, reducing, and eliminating the discharge into any waters of pollutants from sewers which carry storm water or both storm water and pollutants; or

"(2) any project which will demonstrate advanced waste treatment and water purification methods (including the temporary use of new or improved chemical additives which provide substantial immediate improvement to existing treatment processes), or new or improved methods of joint treatment systems for municipal and industrial wastes;

and to include in such grants such amounts as are necessary for the purpose of reports, plans, and specifications in connection therewith.

"(b) The Administrator is authorized to make grants to any State or States or interstate agency to demonstrate, in river basins or portions thereof, advanced treatment and environmental enhancement techniques to control pollution from all sources, within such basins or portions thereof, including nonpoint sources, together with in stream water quality improvement techniques.

"(c) In order to carry out the purposes of section 301 of this Act, the Administrator is authorized to (1) conduct in the Environmental Protection Agency, (2) make grants to persons, and (3) enter into contracts with persons, for research and demonstration projects for prevention of pollution of any waters by industry including, but not limited to, the prevention, reduction, and elimination of the discharge of pollutants. No grant shall be made for any project under this subsection unless the Administrator determines that such project will develop or demonstrate a new or improved method of treating industrial wastes or otherwise prevent pollution by industry, which method shall have industrywide application.

"(d) In carrying out the provisions of this section, the Administrator shall conduct, on a priority basis, an accelerated effort to develop, refine, and achieve practical application of:

"(1) waste management methods applicable to point and nonpoint sources of pollutants to eliminate the discharge of pollutants, including, but not limited to, elimination of runoff of pollutants and the effects of pollutants from inplace or accumulated sources;

"(2) advanced waste treatment methods applicable to point and nonpoint sources, including inplace or accumulated sources of pollutants, and methods for reclaiming and recycling water and confining pollutants so they will not migrate to cause water or other environmental pollution; and

"(3) improved methods and procedures to identify and measure the effects of pollutants on the chemical, physical, and biological integrity of water, including those pollutants created by new technological developments.

"(e) (1) The Administrator is authorized to (A) make, in consultation with the Secretary of Agriculture, grants to persons for research and demonstration projects with respect to new and improved methods of preventing, reducing, and eliminating pollution from agriculture, and (B) disseminate, in cooperation with the Secretary of Agriculture, such information obtained under this subsection, section 104(p), and section 304 as will encourage and enable the adoption of such methods in the agricultural industry.

"(2) The Administrator is authorized, (A) in consultation with other interested Federal agencies, to make grants for demonstration projects with respect to new and improved methods of preventing, reducing, storing, collecting, treating, or otherwise eliminating pollution from sewage in rural and other areas where collection of sewage in conventional, community-wide sewage collection systems is impractical, uneconomical, or otherwise infeasible, or where soil conditions or other factors preclude the use of septic tank and drainage field systems, and (B) in cooperation with other interested Federal and State agencies, to disseminate such information obtained under this subsection as will encourage and enable the adoption of new and improved methods developed pursuant to this subsection.

"(f) Federal grants under subsection (a) of this section shall be subject to the following limitations:

"(1) No grant shall be made for any project unless such project shall have been approved by the appropriate State water pollution control agency or agencies and by the Administrator;

"(2) No grant shall be made for any project in an amount exceeding 75 per centum of cost thereof as determined by the Administrator; and

"(3) No grant shall be made for any project unless the Administrator determines that such project will serve as a useful demonstration for the purpose set forth in clause (1) or (2) of subsection (a).

"(g) Federal grants under subsections (c) and (d) of this section shall not exceed 75 per centum of the cost of the project.

"(h) For the purpose of this section there is authorized to be appropriated $75,000,000 per fiscal year for the fiscal year ending June 30, 1973, the fiscal year ending June 30, 1974, and the fiscal year ending June 30, 1975, and from such appropriations at least 10 per centum of the funds actually appropriated in each fiscal year shall be available only for the purposes of subsection (e).

"GRANTS FOR POLLUTION CONTROL PROGRAMS

"SEC. 106. (a) There are hereby authorized to be appropriated the following sums, to remain available until expended, to carry out the purposes of this section—

"(1) $60,000,000 for the fiscal year ending June 30, 1973; and

"(2) $75,000,000 for the fiscal year ending June 30, 1974, and the fiscal year ending June 30, 1975; for grants to States and to interstate agencies to assist them in administering programs for the prevention, reduction, and elimination of pollution, including enforcement directly or through appropriate State law enforcement officers or agencies.

"(b) From the sums appropriated in any fiscal year, the Administrator shall make allotments to the several States and interstate agencies in accordance with regulations promulgated by him on the basis of the extent of the pollution problem in the respective States.

"(c) The Administrator is authorized to pay to each State and interstate agency each fiscal year either—

"(1) the allotment of such State or agency for such fiscal year under subsection (b), or

"(2) the reasonable costs as determined by the Administrator of developing and carrying out a pollution program by such State or agency during such fiscal year,

which ever amount is the lesser.

"(d) No grant shall be made under this section to any State or interstate agency for any fiscal year when the expenditure of non-Federal funds by such State or interstate agency during such fiscal year for the recurrent expenses of carrying out its pollution control program are less than the expenditure by such State or interstate agency of non-Federal funds for such recurrent program expenses during the fiscal year ending June 30, 1971.

"(e) Beginning in fiscal year 1974 the Administrator shall not make any grant under this section to any State which has not provided or is not carrying out as a part of its program—

"(1) the establishment and operation of appropriate devices, methods, systems, and procedures necessary to monitor, and to compile and analyze data on (including classification according to eutrophic condition), the quality of navigable waters and to the extent practicable, ground waters including biological monitoring; and provision for annually updating such data and including it in the report required under section 305 of this Act;

"(2) authority comparable to that in section 504 of this Act and adequate contingency plans to implement such authority.

"(f) Grants shall be made under this section on condition that—

"(1) Such State (or interstate agency) files with the Administrator within one hundred and twenty days after the date of enactment of this section:

"(A) a summary report of the current status of the State pollution control program, including the criteria used by the State in determining priority of treatment works; and

"(B) such additional information, data, and reports as the Administrator may require.

"(2) No federally assumed enforcement as defined in section 309 (a)(2) is in effect with respect to such State or interstate agency.

"(3) Such State (or interstate agency) submits within one hundred and twenty days after the date of enactment of this section and before July 1 of each year thereafter for the Administrator's approval its program for the prevention, reduction, and elimination of pollution in accordance with purposes and provisions of this Act in such form and content as the Administrator may prescribe.

"(g) Any sums allotted under subsection (b) in any fiscal year which are not paid shall be reallotted by the Administrator in accordance with regulations promulgated by him.

"MINE WATER POLLUTION CONTROL DEMONSTRATIONS

"SEC. 107. (a) The Administrator in cooperation with the Appalachian Regional Commission and other Federal agencies is authorized to conduct, to make grants for, or to contract for, projects to demonstrate comprehensive approaches to the elimination or control of acid or other mine water pollution resulting from active or abandoned mining operations and other environmental pollution affecting water quality within all or part of a watershed or river basin, including siltation from surface mining. Such projects shall demonstrate the engineering and economic feasibility and practicality of various abatement techniques which will contribute substantially to effective and practical methods of acid or other mine water pollution elimination or control, and other pollution affecting water quality, including techniques that demonstrate the engineering and economic feasibility and practicality of using sewage sludge materials and other municipal wastes to diminish or prevent pollution affecting water quality from acid, sedimentation, or other pollutants and in such projects to restore affected lands to usefulness for forestry, agriculture, recreation, or other beneficial purposes.

"(b) Prior to undertaking any demonstration project under this section in the Appalachian region (as defined in section 403 of the Appalachian Regional Development Act of 1965, as amended), the Appalachian Regional Commission shall determine that such demonstration project is consistent with the objectives of the Appalachian Regional Development Act of 1965, as amended.

"(c) The Administrator, in selecting watersheds for the purposes of this section, shall be satisfied that the project area will not be affected adversely by the influx of acid or other mine water pollution from nearby sources.

"(d) Federal participation in such projects shall be subject to the conditions—

"(1) that the State shall acquire any land or interests therein necessary for such project; and

"(2) that the State shall provide legal and practical protection to the project area to insure against any activities which will cause future acid or other mine water pollution.

"(e) There is authorized to be appropriated $30,000,000 to carry out the provisions of this section, which sum shall be available until expended.

"POLLUTION CONTROL IN GREAT LAKES

"SEC. 108. (a) The Administrator, in cooperation with other Federal departments, agencies, and instrumentalities is authorized to enter into agreements with any State, political subdivision, interstate agency, or other public agency, or combination thereof, to carry out one or more projects to demonstrate new methods and techniques and to develop preliminary plans for the elimination or control of pollution, within all or any part of the watersheds of the Great Lakes. Such projects shall demonstrate the engineering and economic feasibility and practicality of removal of pollutants and prevention of any polluting matter from entering into the Great Lakes in the future and other reduction and remedial techniques which will contribute substantially to effective and practical methods of pollution prevention, reduction, or elimination.

"(b) Federal participation in such projects shall be subject to the condition that the State, political subdivision, interstate agency, or other public agency, or combination thereof, shall pay not less than 25 per centum of the actual project costs, which payment may be in any form, including, but not limited to, land or interests therein that is needed for the project, and personal property or services the value of which shall be determined by the Administrator.

"(c) There is authorized to be appropriated $20,000,000 to carry out the provisions of subsections (a) and (b) of this section, which sum shall be available until expended.

"(d)(1) In recognition of the serious conditions which exist in Lake Erie, the Secretary of the Army, acting through the Chief of Engineers, is directed to design and develop a demonstration waste water management program for the rehabilitation and environmental repair of Lake Erie. Prior to the initiation of detailed engineering and design, the program, along with the specific recommendations of the Chief of Engineers, and recommendations for its financing, shall be submitted to the Congress for statutory approval. This authority is in addition to, and not in lieu of, other waste water studies aimed at eliminating pollution emanating from select sources around Lake Erie.

"(2) This program is to be developed in cooperation with the Environmental Protection Agency, other interested departments, agencies, and instrumentalities of the Federal Government, and the States and their political subdivisions. This program shall set forth alternative systems for managing waste water on a regional basis and shall provide local and State governments with a range of choice as to the type of system to be used for the treatment of waste water. These alternative systems shall include both advanced waste treatment technology and land disposal systems including aerated treatment-spray irrigation technology and will also include provisions for the disposal of solid wastes, including sludge. Such program should include measures to control point sources of pollution, area sources of pollution, including acid-mine drainage, urban runoff and rural runoff, and in place sources of pollution, including bottom loads, sludge banks, and polluted harbor dredgings.

"(e) There is authorized to be appropriated $5,000,000 to carry out the provisions of subsection (d) of this section, which sum shall be available until expended.

"TRAINING GRANTS AND CONTRACTS

"SEC. 109. (a) The Administrator is authorized to make grants to or contracts with institutions of higher education, or combinations of such institutions, to assist them in planning, developing, strengthening, improving, or carrying out programs or projects for the preparation of undergraduate students to enter an occupation which involves the design, operation, and maintenance of treatment works, and other facilities whose purpose is water quality control. Such grants or contracts may include payment of all or part of the cost of programs or projects such as—

"(A) planning for the development or expansion of programs or projects for training persons in the operation and maintenance of treatment works;

"(B) training and retraining of faculty members;

"(C) conduct of short-term or regular session institutes for study by persons engaged in, or preparing to engage in, the preparation of students preparing to enter an occupation involving the operation and maintenance of treatment works;

"(D) carrying out innovative and experimental programs of cooperative education involving alternate periods of full-time or part-time academic study at the institution and periods of full-time or part-time employment involving the operation and maintenance of treatment works; and

"(E) research into, and development of, methods of training students or faculty, including the preparation of teaching materials and the planning of curriculum.

"(b)(1) The Administrator may pay 100 per centum of any additional cost of construction of a treatment works required for a facility to train and upgrade waste treatment works operation and maintenance personnel.

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"(2) The Administrator shall make no more than one grant for such additional construction in any State (to serve a group of States, where, in his judgment, efficient training programs require multi-State programs), and shall make such grant after consultation with and approval by the State or States on the basis of (A) the suitability of such facility for training operation and maintenance personnel for treatment works throughout such State or States; and (B) a commitment by the State agency or agencies to carry out at such facility a program of training approved by the Administrator.

"(3) The Administrator may make such grant out of the sums allocated to a State under section 205 of this Act, except that in no event shall the Federal cost of any such training facilities exceed $250,000.

"APPLICATION FOR TRAINING GRANT OR CONTRACT; ALLOCATION OF GRANTS OR CONTRACTS

"SEC. 110. (1) A grant or contract authorized by section 109 may be made only upon application to the Administrator at such time or times and containing such information as he may prescribe, except that no such application shall be approved unless it—

"(A) sets forth programs, activities, research, or development for which a grant is authorized under section 109 and describes the relation to any program set forth by the applicant in an application, if any, submitted pursuant to section 111;

"(B) provides such fiscal control and fund accounting procedures as may be necessary to assure proper disbursement of and accounting for Federal funds paid to the applicant under this section; and

"(C) provides for making such reports, in such form and containing such information, as the Administrator may require to carry out his functions under this section, and for keeping such records and for affording such access thereto as the Administrator may find necessary to assure the correctness and verification of such reports.

"(2) The Administrator shall allocate grants or contracts under section 109 in such manner as will most nearly provide an equitable distribution of the grants or contracts throughout the United States among institutions of higher education which show promise of being able to use funds effectively for the purpose of this section.

"(3)(A) Payment under this section may be used in accordance with regulations of the Administrator, and subject to the terms and conditions set forth in an application approved under paragraph (1), to pay part of the compensation of students employed in connection with the operation and maintenance of treatment works, other than as an employee in connection with the operation and maintenance of treatment works or as an employee in any branch of the Government of the United States, as part of a program for which a grant has been approved pursuant to this section.

"(B) Departments and agencies of the United States are encouraged, to the extent consistent with efficient administration, to enter into arrangements with institutions of higher education for the full-time, part-time, or temporary employment, whether in the competitive or excepted service, of students enrolled in programs set forth in applications approved under paragraph (1).

"AWARD OF SCHOLARSHIPS

"SEC. 111. (1) The Administrator is authorized to award scholarships in accordance with the provisions of this section for undergraduate study by persons who plan to enter an occupation involving the operation and maintenance of treatment works. Such scholarships shall be awarded for such periods as the Administrator may determine but not to exceed four academic years.

"(2) The Administrator shall allocate scholarships under this section among institutions of higher education with programs approved under the provisions of this section for the use of individuals accepted into such programs, in such manner and according to such plan as will insofar as practicable—

"(A) provide an equitable distribution of such scholarships throughout the United States; and

"(B) attract recent graduates of secondary schools to enter an occupation involving the operation and maintenance of treatment works.

"(3) The Administrator shall approve a program of any institution of higher education for the purposes of this section only upon application by the institution and only upon his finding—

"(A) that such program has a principal objective the education and training of persons in the operation and maintenance of treatment works;

"(B) that such program is in effect and of high quality, or can be readily put into effect and may reasonably be expected to be of high quality;

"(C) that the application describes the relation of such program to any program, activity, research, or development set forth by the applicant in an application, if any, submitted pursuant to section 110 of this Act; and

"(D) that the application contains satisfactory assurances that (i) the institution will recommend to the Administrator for the award of scholarships under this section, for study in such program, only persons who have demonstrated to the satisfaction of the institution a serious intent, upon completing the program, to enter an occupation involving the operation and maintenance of treatment works, and (ii) the institution will make reasonable continuing efforts to encourage recipients of scholarships under this section, enrolled in such program, to enter occupations involving the operation and maintenance of treatment works upon completing the program.

"(4)(A) The Administrator shall pay to persons awarded scholarships under this section such stipends (including such allowances for subsistence and other expenses for such persons and their dependents) as he may determine to be consistent with prevailing practices under comparable federally supported programs.

"(B) The Administrator shall (in addition to the stipends paid to persons under paragraph (1)) pay to the institution of higher education at which such person is pursuing his course of study such amount as he may determine to be consistent with prevailing practices under comparable federally supported programs.

"(5) A person awarded a scholarship under the provisions of this section shall continue to receive the payments provided in this section only during such periods as the Administrator finds that he is maintaining satisfactory proficiency and devoting full time to study or research in the field in which such scholarship was awarded in an institution of higher education, and is not engaging in gainful employment other than employment approved by the Administrator by or pursuant to regulation.

"(6) The Administrator shall by regulation provide that any person awarded a scholarship under this section shall agree in writing to enter and remain in an occupation involving the design, operation, or maintenance of treatment works for such period after completion of his course of studies as the Administrator determines appropriate.

"DEFINITIONS AND AUTHORIZATIONS

"SEC. 112. (a) As used in sections 109 through 112 of this Act—

"(1) The term 'institution of higher education' means an educational institution described in the first sentence of section 1201 of the Higher Education Act of 1965 (other than an institution of any agency of the United States) which is accredited by a nationally recognized accrediting agency or association approved by the Administrator for this purpose. For purposes of this subsection, the Administrator shall publish a list of nationally recognized accrediting agencies or associations which he determines to be reliable authority as to the quality of training offered.

"(2) The term 'academic year' means an academic year or its equivalent, as determined by the Administrator.

"(b) The Administrator shall annually report his activities under sections 109 through 112 of this Act, including recommendations for needed revisions in the provisions thereof.

"(c) There are authorized to be appropriated $25,000,000 per fiscal year for the fiscal years ending June 30, 1973, June 30, 1974, and June 30, 1975, to carry out sections 109 through 112 of this Act.

"ALASKA VILLAGE DEMONSTRATION PROJECTS

"SEC. 113. (a) The Administrator is authorized to enter into agreements with the State of Alaska to carry out one or more projects to demonstrate methods to provide for central community facilities for safe water and elimination or control of pollution in those native villages of Alaska without such facilities. Such project shall include provisions for community safe water supply systems, toilets, bathing and laundry facilities, sewage disposal facilities, and other similar facilities, and educational and informational facilities and programs relating to health and hygiene. Such demonstration projects shall be for the further purpose of developing preliminary plans for providing such safe water and such elimination or control of pollution for all native villages in such State.

"(b) In carrying out this section the Administrator shall cooperate with the Secretary of Health, Education, and Welfare for the purpose of utilizing such of the personnel and facilities of that Department as may be appropriate.

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"(c) The Administrator shall report to Congress not later than July 1, 1973, the results of the demonstration projects authorized by this section together with his recommendations, including any necessary legislation, relating to the establishment of a statewide program.

"(d) There is authorized to be appropriated not to exceed $2,000,000 to carry out this section.

"LAKE TAHOE STUDY

"SEC. 114. (a) The Administrator, in consultation with the Tahoe Regional Planning Agency, the Secretary of Agriculture, other Federal agencies, representatives of State and local governments, and

members of the public, shall conduct a thorough and complete study on the adequacy of and need for extending Federal oversight and control in order to preserve the fragile ecology of Lake Tahoe.

"(b) Such study shall include an examination of the interrelationships and responsibilities of the various agencies of the Federal Government and State and local governments with a view to establishing the necessity for redefinition of legal and other arrangements between these various governments, and making specific legislative recommendations to Congress. Such study shall consider the effect of various actions in terms of their environmental impact on the Tahoe Basin, treated as an ecosystem.

"(c) The Administrator shall report on such study to Congress not later than one year after the date of enactment of this subsection.

"(d) There is authorized to be appropriated to carry out this section not to exceed $500,000.

"IN-PLACE TOXIC POLLUTANTS

"SEC. 115. The Administrator is directed to identify the location of in-place pollutants with emphasis on toxic pollutants in harbors and navigable waterways and is authorized, acting through the Secretary of the Army, to make contracts for the removal and appropriate disposal of such materials from critical port and harbor areas. There is authorized to be appropriated $15,000,000 to carry out the provisions of this section, which sum shall be available until expended.

"TITLE II—GRANTS FOR CONSTRUCTION OF TREATMENT WORKS

"PURPOSE

"SEC. 201. (a) It is the purpose of this title to require and to assist the development and implementation of waste treatment management plans and practices which will achieve the goals of this Act.

"(b) Waste treatment management plans and practices shall provide for the application of the best practicable waste treatment technology before any discharge into receiving waters, including reclaiming and recycling of water, and confined disposal of pollutants so they will not migrate to cause water or other environmental pollution and shall provide for consideration of advanced waste treatment techniques.

"(c) To the extent practicable, waste treatment management shall be on an areawide basis and provide control or treatment of all point and nonpoint sources of pollution, including in place or accumulated pollution sources.

"(d) The Administrator shall encourage waste treatment management which results in the construction of revenue producing facilities providing for—

"(1) the recycling of potential sewage pollutants through the production of agriculture, silviculture, or aquaculture products, or any combination thereof;

"(2) the confined and contained disposal of pollutants not recycled;

"(3) the reclamation of wastewater; and

"(4) the ultimate disposal of sludge in a manner that will not result in environmental hazards.

"(e) The Administrator shall encourage waste treatment management which results in integrating facilities for sewage treatment and recycling with facilities to treat, dispose of, or utilize other industrial and municipal wastes, including but not limited to solid waste and waste heat and thermal discharges. Such integrated facilities shall be designed and operated to produce revenues in excess of capital and operation and maintenance costs and such revenues shall be used by the designated regional management agency to aid in financing other environmental improvement programs.

"(f) The Administrator shall encourage waste treatment management which combines 'open space' and recreational considerations with such management.

"(g)(1) The Administrator is authorized to make grants to any State, municipality, or intermunicipal or interstate agency for the construction of publicly owned treatment works.

"(2) The Administrator shall not make grants from funds authorized for any fiscal year beginning after June 30, 1974, to any State, municipality, or intermunicipal or interstate agency for the erection, building, acquisition, alteration, remodeling, improvement, or extension of treatment works unless the grant applicant has satisfactorily demonstrated to the Administrator that—

"(A) alternative waste management techniques have been studied and evaluated and the works proposed for grant assistance will provide for the application of the best practicable waste treatment technology over the life of the works consistent with the purposes of this title; and

"(B) as appropriate, the works proposed for grant assistance will take into account and allow to the extent practicable the application of technology at a later date which will provide for the reclaiming or recycling of water or otherwise eliminate the discharge of pollutants.

"(3) The Administrator shall not approve any grant after July 1, 1973, for treatment works under this section unless the applicant shows to the satisfaction of the Administrator that each sewer collection system discharging into such treatment works is not subject to excessive infiltration.

"(4) The Administrator is authorized to make grants to applicants for treatment works grants under this section for such sewer system evaluation studies as may be necessary to carry out the requirements of paragraph (3) of this subsection. Such grants shall be made in accordance with rules and regulations promulgated by the Administrator. Initial rules and regulations shall be promulgated under this paragraph not later than 120 days after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972.

"FEDERAL SHARE

"SEC. 202. (a) The amount of any grant for treatment works made under this Act from funds authorized for any fiscal year beginning after June 30, 1971, shall be 75 per centum of the cost of construction thereof (as approved by the Administrator). Any grant (other than for reimbursement) made prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972 from any funds authorized for any fiscal year beginning after June 30, 1971, shall, upon the request of the applicant, be increased to the applicable percentage under this section.

"(b) The amount of the grant for any project approved by the Administrator after January 1, 1971, and before July 1, 1971, for the construction of treatment works, the actual erection, building or acquisition of which was not commenced prior to July 1, 1971, shall, upon the request of the applicant, be increased to the applicable percentage under subsection (a) of this section for grants for treatment works from funds for fiscal years beginning after June 30, 1971, with respect to the cost of such actual erection, building, or acquisition. Such increased amount shall be paid from any funds allocated to the State in which the treatment works is located without regard to the fiscal year for which such funds were authorized. Such increased amount shall be paid for such project only if—

"(1) a sewage collection system that is a part of the same total waste treatment system as the treatment works for which such grant was approved is under construction or is to be constructed for use in conjunction with such treatment works, and if the cost of such sewage collection system exceeds the cost of such treatment works, and

"(2) the State water pollution control agency or other appropriate State authority certifies that the quantity of available ground water will be insufficient, inadequate, or unsuitable for public use, including the ecological preservation and recreational use of surface water bodies, unless effluents from publicly-owned treatment works after adequate treatment are returned to the ground water consistent with acceptable technological standards.

"PLANS, SPECIFICATIONS, ESTIMATES, AND PAYMENTS

"SEC. 203. (a) Each applicant for a grant shall submit to the Administrator for his approval, plans, specifications, and estimates for each proposed project for the construction of treatment works for which a grant is applied for under section 201(g)(1) from funds allotted to the State under section 205 and which otherwise meets the requirements of this Act. The Administrator shall act upon such plans, specifications, and estimates as soon as practicable after the same have been submitted, and his approval of any such plans, specifications, and estimates shall be deemed a contractual obligation of the United States for the payment of its proportional contribution to such project.

"(b) The Administrator shall, from time to time as the work progresses, make payments to the recipient of a grant for costs of construction incurred on a project. These payments shall at no time exceed the Federal share of the cost of construction incurred to the date of the voucher covering such payment plus the Federal share of the value of the materials which have been stockpiled in the vicinity of such construction in conformity to plans and specifications for the project.

"(c) After completion of a project and approval of the final voucher by the Administrator, he shall pay out of the appropriate sums the unpaid balance of the Federal share payable on account of such project.

(d) Nothing in this Act shall be construed to require, or to authorize the Administrator to require, that grants under this Act for construction of treatment works be made only for projects which are operable units usable for sewage collection, transportation, storage, waste treatment, or for similar purposes without additional construction.

"LIMITATIONS AND CONDITIONS

"SEC. 204. (a) Before approving grants for any project for any treatment works under section 201(g)(1) the Administrator shall determine—

"(1) that such works are included in any applicable areawide waste treatment management plan developed under section 208 of this Act;

"(2) that such works are in conformity with any applicable State plan under section 303(e) of this Act;

"(3) that such works have been certified by the appropriate State water pollution control agency as entitled to priority over

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such other works in the State in accordance with any applicable State plan under section 303(e) of this Act;

"(4) that the applicant proposing to construct such works agrees to pay the non-Federal costs of such works and has made adequate provisions satisfactory to the Administrator for assuring proper and efficient operation, including the employment of trained management and operations personnel, and the maintenance of such works in accordance with a plan of operation approved by the State water pollution control agency or, as appropriate, the interstate agency, after construction thereof;

"(5) that the size and capacity of such works relate directly to the needs to be served by such works, including sufficient reserve capacity. The amount of reserve capacity provided shall be approved by the Administrator on the basis of a comparison of the cost of constructing such reserves as a part of the works to be funded and the anticipated cost of providing expanded capacity at a date when such capacity will be required;

"(6) that no specification for bids in connection with such works shall be written in such a manner as to contain proprietary, exclusionary, or discriminatory requirements other than those based upon performance, unless such requirements are necessary to test or demonstrate a specific thing or to provide for necessary interchangeability of parts and equipment, or at least two brand names or trade names of comparable quality or utility are listed and are followed by the words 'or equal'.

"(b)(1) Notwithstanding any other provision of this title, the Administrator shall not approve any grant for any treatment works under section 201(g)(1) after March 1, 1973, unless he shall first have determined that the applicant (A) has adopted or will adopt a system of charges to assure that each recipient of waste treatment services within the applicant's jurisdiction, as determined by the Administrator, will pay its proportionate share of the costs of operation and maintenance (including replacement) of any waste treatment services provided by the applicant; (B) has made provision for the payment to such applicant by the industrial users of the treatment works, of that portion of the cost of construction of such treatment works (as determined by the Administrator) which is allocable to the treatment of such industrial wastes to the extent attributable to the Federal share of the cost of construction; and (C) has legal, institutional, managerial, and financial capability to insure adequate construction, operation, and maintenance of treatment works throughout the applicant's jurisdiction, as determined by the Administrator.

"(2) The Administrator shall, within one hundred and eighty days after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, and after consultation with appropriate state, interstate, municipal, and intermunicipal agencies, issue guidelines applicable to payment of waste treatment costs by industrial and nonindustrial recipients of waste treatment services which shall establish (A) classes of users of such services, including categories of industrial users; (B) criteria against which to determine the adequacy of charges imposed on classes and categories of users reflecting all factors that influence the cost of waste treatment, including strength, volume, and delivery flow rate characteristics of waste; and (C) model systems and rates of user charges typical of various treatment works serving municipal-industrial communities.

"(3) The grantee shall retain an amount of the revenues derived from the payment of costs by industrial users of waste treatment services, to the extent costs are attributable to the Federal share of eligible project costs provided pursuant to this title as determined by the Administrator, equal to (A) the amount of the non-Federal cost of such project paid by the grantee plus (B) the amount, determined in accordance with regulations promulgated by the Administrator, necessary for future expansion and reconstruction of the project, except that such retained amount shall not exceed 50 per centum of such revenues from such project. All revenues from such project not retained by the grantee shall be deposited by the Administrator in the Treasury as miscellaneous receipts. That portion of the revenues retained by the grantee attributable to clause (B) of the first sentence of this paragraph, together with any interest thereon shall be used solely for the purposes of future expansion and reconstruction of the project.

"(4) Approval by the Administrator of a grant to an interstate agency established by interstate compact for any treatment works shall satisfy any other requirement that such works be authorized by Act of Congress.

"ALLOTMENT

"SEC. 205. (a) Sums authorized to be appropriated pursuant to section 207 for each fiscal year beginning after June 30, 1972, shall be allotted by the Administrator not later than the January 1st immediately preceding the beginning of the fiscal year for which authorized, except that the allotment for fiscal year 1973 shall be made not later than 30 days after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972. Such sums shall be allotted among the States by the Administrator in accordance with regulations promulgated by him, in the ratio that the estimated cost of constructing all needed publicly owned treatment works in each State bears to the estimated cost of construction of all needed publicly owned treatment works in all of the States. For the fiscal years ending June 30, 1973, and June 30, 1974, such ratio shall be determined on the basis of table III of House Public Works Committee Print No. 92-50. For the fiscal year ending June 30, 1975, such ratio shall be determined one-half on the basis of table I of House Public Works Committee Print Numbered 93-28 and one-half on the basis of table II of such print, except that no State shall receive an allotment less than that which it received for the fiscal year ending June 30, 1972, as set forth in table III of such print. Allotments for fiscal years which begin after the fiscal year ending June 30, 1975, shall be made only in accordance with a revised cost estimate made and submitted to Congress in accordance with section 516 (b) of this Act and only after such revised cost estimate shall have been approved by law specifically enacted hereafter.

"(b)(1) Any sums allotted to a State under subsection (a) shall be available for obligation under section 203 on and after the date of such allotment. Such sums shall continue available for obligation in such State for a period of one year after the close of the fiscal year for which such sums are authorized. Any amounts so allotted which are not obligated by the end of such one-year period shall be immediately reallotted by the Administrator, in accordance with regulations promulgated by him, generally on the basis of the ratio used in making the last allotment of sums under this section. Such reallotted sums shall be added to the last allotments made to the States. Any sum made available to a State by reallotment under this subsection shall be in addition to any funds otherwise allotted to such State for grants under this title during any fiscal year.

"(2) Any sums which have been obligated under section 203 and which are released by the payment of the final voucher for the project shall be immediately credited to the State to which such sums were last allotted. Such released sums shall be added to the amounts last allotted to such State and shall be immediately available for obligation in the same manner and to the same extent as such last allotment.

"REIMBURSEMENT AND ADVANCED CONSTRUCTION

"SEC. 206. (a) Any publicly owned treatment works in a State on which construction was initiated after June 30, 1966, but before July 1, 1972, which was approved by the appropriate State water pollution control agency and which the Administrator finds meets the requirements of section 8 of this Act in effect at the time of the initiation of construction shall be reimbursed a total amount equal to the difference between the amount of Federal financial assistance, if any, received under such section 8 for such project and 50 per centum of the cost of such project, or 55 per centum of the project cost where the Administrator also determines that such treatment works was constructed in conformity with a comprehensive metropolitan treatment plan as described in section 8(f) of the Federal Water Pollution Control Act as in effect immediately prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972. Nothing in this subsection shall result in any such works receiving Federal grants from all sources in excess of 80 per centum of the cost of such project.

"(b) Any publicly owned treatment works constructed with or eligible for Federal financial assistance under this Act in a State between June 30, 1956, and June 30, 1966, which was approved by the State water pollution control agency and which the Administrator finds meets the requirements of section 8 of this Act prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972 but which was constructed without assistance under such section 8 or which received such assistance in an amount less than 30 per centum of the cost of such project shall qualify for payments and reimbursement of State or local funds used for such project from sums allocated to such State under this section in an amount which shall not exceed the difference between the amount of such assistance, if any, received for such project and 30 per centum of the cost of such project.

"(c) No publicly owned treatment works shall receive any payment or reimbursement under subsection (a) or (b) of this section unless an application for such assistance is filed with the Administrator within the one year period which begins on the date of enactment of the Federal Water Pollution Control Act Amendments of 1972. Any application filed within such one year period may be revised from time to time, as may be necessary.

Editor's Note: Section 206 (c) was amended by Public Law 93-207 as follows: SEC. 2. Notwithstanding the requirements of subsection (c) of section 206 of the Federal Water Pollution Control Act (86 Stat. 838), applications for assistance under section 206 may be filed with the Administrator of the Environmental Protection Agency until January 31, 1974.

"(d) The Administrator shall allocate to each qualified project under subsection (a) of this section each fiscal year for which funds are appropriated under subsection (e) of this section an amount which bears the same ratio to the unpaid balance of the reimbursement due such project as the total of such funds for such year bears to the total unpaid balance of reimbursement due all such approved projects on the date of enactment of such appropriation. The Administrator shall allocate to each qualified project under subsection (b) of this section each fiscal year for which funds are appropriated under subsection (e) of this section an amount which bears the same ratio to the unpaid balance of the reimbursement due such project as the total of such funds

for such year bears to the total unpaid balance of reimbursement due all such approved projects on the date of enactment of such appropriation.

Editor's Note: Section 206 (d) was amended by Public Law 93-207 as follows: SEC. 3. Funds available for reimbursement under Public Law 92-399 shall be allocated in accordance with subsection (d) of section 206 of the Federal Water Pollution Control Act (86 Stat. 838), pro rata among all projects eligible under subsection (a) of such section 206 for which applications have been submitted and approved by the Administrator pursuant to such Act. Notwithstanding the provisions of subsection (d) of such section 206, (1) the Administrator is authorized to make interim payments to each such project for which an application has been approved on the basis of estimates of maximum pro rata entitlement of all applicants under section 206 (a) and (2) for the purpose of determining allocation of sums available under Public Law 92-399, the unpaid balance of reimbursement due such projects shall be computed as of January 31, 1974. Upon completion by the Administrator of his audit and approval of all projects for which an application has been filed under subsection (a) of such section 206, the Administrator shall, within the limits of appropriated funds, allocate to each such qualified project the amount remaining, if any, of its total entitlement. Amounts allocated to projects which are later determined to be in excess of entitlement shall be available for reallocation, until expended, to other qualified projects under subsection (a) of such section 206. In no event, however, shall any payments exceed the Federal share of the cost of construction incurred to the date of the voucher covering such payments plus the Federal share of the value of the materials which have been stockpiled in the vicinity of such construction in conformity to plans and specifications for the project.

"(e) There is authorized to be appropriated to carry out subsection (a) of this section not to exceed $2,600,000,000 and, to carry out subsection (b) of this section, not to exceed $750,000,000. The authorizations contained in this subsection shall be the sole source of funds for reimbursements authorized by this section.

"(f)(1) In any case where all funds allotted to a State under this title have been obligated under section 203 of this Act, and there is construction of any treatment works project without the aid of Federal funds and in accordance with all procedures and all requirements applicable to treatment works projects, except those procedures and requirements which limit construction of projects to those constructed with the aid of previously allotted Federal funds, the Administrator, upon his approval of an application made under this subsection therefor, is authorized to pay the Federal share of the cost of construction of such project when additional funds are allotted to the State under this title if prior to the construction of the project the Administrator approves plans, specifications, and estimates therefor in the same manner as other treatment works projects. The Administrator may not approve an application under this subsection unless an authorization is in effect for the future fiscal year for which the application requests payment, which authorization will insure such payment without exceeding the State's expected allotment from such authorization.

"(2) In determining the allotment for any fiscal year under this title, any treatment works project constructed in accordance with this section and without the aid of Federal funds shall not be considered completed until an application under the provisions of this subsection with respect to such project has been approved by the Administrator, or the availability of funds from which this project is eligible for reimbursement has expired, whichever first occurs.

"AUTHORIZATION

"SEC. 207. There is authorized to be appropriated to carry out this title, other than sections 206 (e), 208 and 209, for the fiscal year ending June 30, 1973, not to exceed $5,000,000,000, for the fiscal year ending June 30, 1974, not to exceed $6,000,000,000, and for the fiscal year ending June 30, 1975, not to exceed $7,000,000,000.

"AREAWIDE WASTE TREATMENT MANAGEMENT

"SEC. 208. (a) For the purpose of encouraging and facilitating the development and implementation of areawide waste treatment management plans—

"(1) The Administrator, within ninety days after the date of enactment of this Act and after consultation with appropriate Federal, State, and local authorities, shall by regulation publish guidelines for the identification of those areas which, as a result of urban-industrial concentrations or other factors, have substantial water quality control problems.

"(2) The Governor of each State, within sixty days after publication of the guidelines issued pursuant to paragraph (1) of this subsection, shall identify each area within the State which, as a result of urban-industrial concentrations or other factors, has substantial water quality control problems. Not later than one hundred and twenty days following such identification and after consultation with appropriate elected and other officials of local governments having jurisdiction in such areas, the Governor shall designate (A) the boundaries of each such area, and (B) a single representative organization, including elected officials from local governments or their designees, capable of developing effective areawide waste treatment management plans for such area. The Governor may in the same manner at any later time identify any additional area (or modify an existing area) for which he determines areawide waste treatment management to be appropriate, designate the boundaries of such area, and designate an organization capable of developing effective areawide waste treatment management plans for such area.

"(3) With respect to any area which, pursuant to the guidelines published under paragraph (1) of this subsection, is located in two or more States, the Governors of the respective States shall consult and cooperate in carrying out the provisions of paragraph (2), with a view toward designating the boundaries of the interstate area having common water quality control problems and for which areawide waste treatment management plans would be most effective, and toward designating, within one hundred and eighty days after publication of guidelines issued pursuant to paragraph (1) of this subsection, of a single representative organization capable of developing effective areawide waste treatment management plans for such area.

"(4) If a Governor does not act, either by designating or determining not to make a designation under paragraph (2) of this subsection, within the time required by such paragraph, or if, in the case of an interstate area, the Governors of the States involved do not designate a planning organization within the time required by paragraph (3) of this subsection, the chief elected officials of local governments within an area may by agreement designate (A) the boundaries for such an area, and (B) a single representative organization including elected officials from such local governments, or their designees, capable of developing an areawide waste treatment management plan for such area.

"(5) Existing regional agencies may be designated under paragraphs (2), (3), and (4) of this subsection.

"(6) The State shall act as a planning agency for all portions of such State which are not designated under paragraphs (2), (3), or (4) of this subsection.

"(7) Designations under this subsection shall be subject to the approval of the Administrator.

"(b)(1) Not later than one year after the date of designation of any organization under subsection (a) of this section such organization shall have in operation a continuing areawide waste treatment management planning process consistent with section 201 of this Act. Plans prepared in accordance with this process shall contain alternatives for waste treatment management, and be applicable to all wastes generated within the area involved. The initial plan prepared in accordance with such process shall be certified by the Governor and submitted to the Administrator not later than two years after the planning process is in operation.

"(2) Any plan prepared under such process shall include, but not be limited to—

"(A) the identification of treatment works necessary to meet the anticipated municipal and industrial waste treatment needs of the area over a twenty-year period, annually updated (including an analysis of alternative waste treatment systems), including any requirements for the acquisition of land for treatment purposes; the necessary waste water collection and urban storm water runoff systems; and a program to provide the necessary financial arrangements for the development of such treatment works;

"(B) the establishment of construction priorities for such treatment works and time schedules for the initiation and completion of all treatment works;

"(C) the establishment of a regulatory program to—

"(i) implement the waste treatment management requirements of section 201(c),

"(ii) regulate the location, modification, and construction of any facilities within such area which may result in any discharge in such area, and

"(iii) assure that any industrial or commercial wastes discharged into any treatment works in such area meet applicable pretreatment requirements;

"(D) the identification of those agencies necessary to construct, operate, and maintain all facilities required by the plan and otherwise to carry out the plan;

"(E) the identification of the measures necessary to carry out the plan (including financing), the period of time necessary to carry out the plan, the costs of carrying out the plan within such time, and the economic, social, and environmental impact of carrying out the plan within such time;

"(F) a process to (i) identify, if appropriate, agriculturally and silviculturally related nonpoint sources of pollution, including runoff from manure disposal areas, and from land used for livestock and crop production, and (ii) set forth procedures and methods (including land use requirements) to control to the extent feasible such sources;

"(G) a process to (i) identify, if appropriate, mine-related sources of pollution including new, current, and abandoned surface and underground mine runoff, and (ii) set forth procedures

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and methods (including land use requirements) to control to the extent feasible such sources;

"(H) a process to (i) identify construction activity related sources of pollution, and (ii) set forth procedures and methods (including land use requirements) to control to the extent feasible such sources;

"(I) a process to (i) identify, if appropriate, salt water intrusion into rivers, lakes, and estuaries resulting from reduction of fresh water flow from any cause, including irrigation, obstruction, ground water extraction, and diversion, and (ii) set forth procedures and methods to control such intrusion to the extent feasible where such procedures and methods are otherwise a part of the waste treatment management plan;

"(J) a process to control the disposition of all residual waste generated in such area which could affect water quality; and

"(K) a process to control the disposal of pollutants on land or in subsurface excavations within such area to protect ground and surface water quality.

"(3) Areawide waste treatment management plans shall be certified annually by the Governor or his designee (or Governors or their designees, where more than one State is involved) as being consistent with applicable basin plans and such areawide waste treatment management plans shall be submitted to the Administrator for his approval.

"(4) Whenever the Governor of any State determines (and notifies the Administrator) that consistency with a statewide regulatory program under section 303 so requires, the requirements of clauses (F) through (K) of paragraph (2) of this subsection shall be developed and submitted by the Governor to the Administrator for application to all regions within such State.

"(c)(1) The Governor of each State, in consultation with the planning agency designated under subsection (a) of this section, at the time a plan is submitted to the Administrator, shall designate one or more waste treatment management agencies (which may be an existing or newly created local, regional, or State agency or political subdivision) for each area designated under subsection (a) of this section and submit such designations to the Administrator.

"(2) The Administrator shall accept any such designation, unless, within 120 days of such designation, he finds that the designated management agency (or agencies) does not have adequate authority—

"(A) to carry out appropriate portions of an areawide waste treatment management plan developed under subsection (b) of this section;

"(B) to manage effectively waste treatment works and related facilities serving such area in conformance with any plan required by subsection (b) of this section;

"(C) directly or by contract, to design and construct new works, and to operate and maintain new and existing works as required by any plan developed pursuant to subsection (b) of this section;

"(D) to accept and utilize grants, or other funds from any source, for waste treatment management purposes;

"(E) to raise revenues, including the assessment of waste treatment charges;

"(F) to incur short- and long-term indebtedness;

"(G) to assure in implementation of an areawide waste treatment management plan that each participating community pays its proportionate share of treatment costs;

"(H) to refuse to receive any wastes from any municipality or subdivision thereof, which does not comply with any provisions of an approved plan under this section applicable to such area; and

"(I) to accept for treatment industrial wastes.

"(d) After a waste treatment management agency having the authority required by subsection (c) has been designated under such subsection for an area and a plan for such area has been approved under subsection (b) of this section, the Administrator shall not make any grant for construction of a publicly owned treatment works under section 201(g)(1) within such area except to such designated agency and for works in conformity with such plan.

"(e) No permit under section 402 of this Act shall be issued for any point source which is in conflict with a plan approved pursuant to subsection (b) of this section.

"(f)(1) The Administrator shall make grants to any agency designated under subsection (a) of this section for payment of the reasonable costs of developing and operating a continuing areawide waste treatment management planning process under subsection (b) of this section.

"(2) The amount granted to any agency under paragraph (1) of this subsection shall be 100 per centum of the costs of developing and operating a continuing areawide waste treatment management planning process under subsection (b) of this section for each of the fiscal years ending on June 30, 1973, June 30, 1974, and June 30, 1975, and shall not exceed 75 per centum of such costs in each succeeding fiscal year.

"(3) Each applicant for a grant under this subsection shall submit to the Administrator for his approval each proposal for which a grant is applied for under this subsection. The Administrator shall act upon such proposal as soon as practicable after it has been submitted, and his approval of that proposal shall be deemed a contractual obligation of the United States for the payment of its contribution to such proposal. There is authorizd to be appropriated to carry out this subsection not to exceed $50,000,000 for the fiscal year ending June 30, 1973, not to exceed $100,000,000 for the fiscal year ending June 30, 1974, and not to exceed $150,000,000 for the fiscal year ending June 30, 1975.

"(g) The Administrator is authorized, upon request of the Governor or the designated planning agency, and without reimbursement, to consult with, and provide technical assistance to, any agency designated under subsection (a) of this section in the development of areawide waste treatment management plans under subsection (b) of this section.

"(h)(1) The Secretary of the Army, acting through the Chief of Engineers, in cooperation with the Administrator is authorized and directed, upon request of the Governor or the designated planning organization, to consult with, and provide technical assistance to, any agency designed under subsection (a) of this section in developing and operating a continuing areawide waste treatment management planning process under subsection (b) of this section.

"(2) There is authorized to be appropriated to the Secretary of the Army, to carry out this subsection, not to exceed $50,000,000 per fiscal year for the fiscal years ending June 30, 1973, and June 30, 1974.

"BASIN PLANNING

"SEC. 209 (a) The President, acting through the Water Resources Council, shall, as soon as practicable, prepare a Level B plan under the Water Resources Planning Act for all basins in the United States. All such plans shall be completed not later than January 1, 1980, except that priority in the preparation of such plans shall be given to those basins and portions thereof which are within those areas designated under paragraphs (2), (3), and (4) of subsection (a) of section 208 of this Act.

"(b) The President, acting through the Water Resources Council, shall report annually to Congress on progress being made in carrying out this section. The first such report shall be submitted not later than January 31, 1973.

"(c) There is authorized to be appropriated to carry out this section not to exceed $200,000,000.

"ANNUAL SURVEY

"SEC. 210. The Administrator shall annually make a survey to determine the efficiency of the operation and maintenance of treatment works constructed with grants made under this Act, as compared to the efficiency planned at the time the grant was made. The results of such annual survey shall be included in the report required under section 516(a) of this Act.

"SEWAGE COLLECTION SYSTEMS

"SEC. 211. No grant shall be made for a sewage collection system under this title unless such grant (1) is for replacement or major rehabilitation of an existing collection system and is necessary to the total integrity and performance of the waste treatment works servicing such community, or (2) is for a new collection system in an existing community with sufficient existing or planned capacity adequately to treat such collected sewage and is consistent with section 201 of this Act.

"DEFINITIONS

"SEC. 212. As used in this title—

"(1) The term 'construction' means any one or more of the following: preliminary planning to determine the feasibility of treatment works, engineering, architectural, legal, fiscal, or economic investigations or studies, surveys, designs, plans, working drawings, specifications, procedures, or other necessary actions, erection, building, acquisition, alteration, remodeling, improvement, or extension of treatment works, or the inspection or supervision of any of the foregoing items.

"(2)(A) The term 'treatment works' means any devices and systems used in the storage, treatment, recycling, and reclamation of municipal sewage or industrial wastes of a liquid nature to implement section 201 of this Act, or necessary to recycle or reuse water at the most economical cost over the estimated life of the works, including intercepting sewers, outfall sewers, sewage collection systems, pumping, power, and other equipment, and their appurtenances; extensions, improvements, remodeling, additions, and alterations thereof; elements essential to provide a reliable recycled supply such as standby treatment units and clear well facilities; and any works, including site acquisition of the land that will be an integral part of the treatment process or is used for ultimate disposal of residues resulting from such treatment.

"(B) In addition to the definition contained in subparagraph (A) of this paragraph, 'treatment works' means any other method or system for preventing, abating, reducing, storing, treating, separating,

or disposing of municipal waste, including storm water runoff, or industrial waste, including waste in combined storm water and sanitary sewer systems. Any application for construction grants which includes wholly or in part such methods or systems shall, in accordance with guidelines published by the Administrator pursuant to subparagraph (C) of this paragraph, contain adequate data and analysis demonstrating such proposal to be, over the life of such works, the most cost efficient alternative to comply with sections 301 or 302 of this Act, or the requirements of section 201 of this Act.

"(C) For the purposes of subparagraph (B) of this paragraph, the Administrator shall, within one hundred and eighty days after the date of enactment of this title, publish and thereafter revise no less often than annually, guidelines for the evaluation of methods, including cost-effective analysis, described in subparagraph (B) of this paragraph.

"(3) The term 'replacement' as used in this title means those expenditures for obtaining and installing equipment, accessories, or appurtenances during the useful life of the treatment works necessary to maintain the capacity and performance for which such works are designed and constructed.

"LOAN GUARANTEES FOR CONSTRUCTION OF TREATMENT WORKS

"SEC. 213. (a) Subject to the conditions of this section and to such terms and conditions as the Administrator determines to be necessary to carry out the purposes of this title, the Administrator is authorized to guarantee, and to make commitments to guarantee, the principal and interest (including interest accruing between the date of default and the date of the payment in full of the guarantee) of any loan, obligation, or participation therein of any State, municipality, or intermunicipal or interstate agency issued directly and exclusively to the Federal Financing Bank to finance that part of the cost of any grant-eligible project for the construction of publicly owned treatment works not paid for with Federal financial assistance under this title (other than this section), which project the Administrator has determined to be eligible for such financial assistance under this title, including, but not limited to, projects eligible for reimbursement under section 206 of this title.

"(b) No guarantee, or commitment to make a guarantee, may be made pursuant to this section—

"(1) unless the Administrator certifies that the issuing body is unable to obtain on reasonable terms sufficient credit to finance its actual needs without such guarantee; and

"(2) unless the Administrator determines that there is a reasonable assurance of repayment of the loan, obligation, or participation therein.

A determination of whether financing is available at reasonable rates shall be made by the Secretary of the Treasury with relationship to the current average yield on outstanding marketable obligations of municipalities of comparable maturity.

"(c) The Administrator is authorized to charge reasonable fees for the investigation of an application for a guarantee and for the issuance of a commitment to make a guarantee.

"(d) The Administrator, in determining whether there is a reasonable assurance of repayment, may require a commitment which would apply to such repayment. Such commitment may include, but not be limited to, (1) all or any portion of the funds retained by such grantee under section 204(b)(3) of this Act, and (2) any funds received by such grantee from the amounts appropriated under section 206 of this Act.".

"TITLE III—STANDARDS AND ENFORCEMENT

"EFFLUENT LIMITATIONS

"SEC. 301. (a) Except as in compliance with this section and sections 302, 306, 307, 318, 402, and 404 of this Act, the discharge of any pollutant by any person shall be unlawful.

"(b) In order to carry out the objective of this Act there shall be achieved—

"(1)(A) not later than July 1, 1977, effluent limitations for point sources, other than publicly owned treatment works, (i) which shall require the application of the best practicable control technology currently available as defined by the Administrator pursuant to section 304(b) of this Act, or (ii) in the case of a discharge into a publicly owned treatment works which meets the requirements of subparagraph (B) of this paragraph, which shall require compliance with any applicable pretreatment requirements and any requirements under section 307 of this Act; and

"(B) for publicly owned treatment works in existence on July 1, 1977, or approved pursuant to section 203 of this Act prior to June 30, 1974 (for which construction must be completed within four years of approval), effluent limitations based upon secondary treatment as defined by the Administrator pursuant to section 304(d)(1) of this Act; or,

"(C) not later than July 1, 1977, any more stringent limitation, including those necessary to meet water quality standards, treatment standards, or schedules of compliance, established pursuant to any State law or regulations (under authority preserved by section 510) or any other Federal law or regulation, or required to implement any applicable water quality standard established pursuant to this Act.

"(2)(A) not later than July 1, 1983, effluent limitations for categories and classes of point sources, other than publicly owned treatment works, which (i) shall require application of the best available technology economically achievable for such category or class, which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants, as determined in accordance with regulations issued by the Administrator pursuant to section 304(b)(2) of this Act, which such effluent limitations shall require the elimination of discharges of all pollutants if the Administrator finds, on the basis of information available to him (including information developed pursuant to section 315), that such elimination is technologically and economically achievable for a category or class of point sources as determined in accordance with regulations issued by the Administrator pursuant to section 304(b)(2) of this Act, or (ii) in the case of the introduction of a pollutant into a publicly owned treatment works which meets the requirements of subparagraph (B) of this paragraph, shall require compliance with any applicable pretreatment requirements and any other requirement under section 307 of this Act; and

"(B) not later than July 1, 1983, compliance by all publicly owned treatment works with the requirements set forth in section 201(g)(2)(A) of this Act.

"(c) The Administrator may modify the requirements of subsection (b)(2)(A) of this section with respect to any point source for which a permit application is filed after July 1, 1977, upon a showing by the owner or operator of such point source satisfactory to the Administrator that such modified requirements (1) will represent the maximum use of technology within the economic capability of the owner or operator; and (2) will result in reasonable further progress toward the elimination of the discharge of pollutants.

"(d) Any effluent limitation required by paragraph (2) of subsection (b) of this section shall be reviewed at least every five years and, if appropriate, revised pursuant to the procedure established under such paragraph.

"(e) Effluent limitations established pursuant to this section or section 302 of this Act shall be applied to all point sources of discharge of pollutants in accordance with the provisions of this Act.

"(f) Notwithstanding any other provisions of this Act it shall be unlawful to discharge any radiological, chemical, or biological warfare agent or high-level radioactive waste into the navigable waters.

"WATER QUALITY RELATED EFFLUENT LIMITATIONS

"SEC. 302. (a) Whenever, in the judgment of the Administrator, discharges of pollutants from a point source or group of point sources, with the application of effluent limitations required under section 301(b)(2) of this Act, would interfere with the attainment or maintenance of that water quality in a specific portion of the navigable waters which shall assure protection of public water supplies, agricultural and industrial uses, and the protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water, effluent limitations (including alternative effluent control strategies) for such point source or sources shall be established which can reasonably be expected to contribute to the attainment or maintenance of such water quality.

"(b)(1) Prior to establishment of any effluent limitation pursuant to subsection (a) of this section, the Administrator shall issue notice of intent to establish such limitation and within ninety days of such notice hold a public hearing to determine the relationship of the economic and social costs of achieving any such limitation or limitations, including any economic or social dislocation in the affected community or communities, to the social and economic benefits to be obtained (including the attainment of the objective of this Act) and to determine whether or not such effluent limitations can be implemented with available technology or other alternative control strategies.

"(2) If a person affected by such limitation demonstrates at such hearing that (whether or not such technology or other alternative control strategies are available) there is no reasonable relationship between the economic and social costs and the benefits to be obtained (including attainment of the objective of this Act), such limitation shall not become effective and the Administrator shall adjust such limitation as it applies to such person.

"(c) The establishment of effluent limitations under this section shall not operate to delay the application of any effluent limitation established under section 301 of this Act.

"WATER QUALITY STANDARDS AND IMPLEMENTATION PLANS

"SEC. 303. (a)(1) In order to carry out the purpose of this Act, any water quality standard applicable to interstate waters which was adopted by any State and submitted to, and approved by, or is awaiting

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approval by, the Administrator pursuant to this Act as in effect immediately prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, shall remain in effect unless the Administrator determined that such standard is not consistent with the applicable requirements of this Act as in effect immediately prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972. If the Administrator makes such a determination he shall, within three months after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, notify the State and specify the changes needed to meet such requirements. If such changes are not adopted by the State within ninety days after the date of such notification, the Administrator shall promulgate such changes in accordance with subsection (b) of this section.

"(2) Any State which, before the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, has adopted, pursuant to its own law, water quality standards applicable to intrastate waters shall submit such standards to the Administrator within thirty days after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972. Each such standard shall remain in effect, in the same manner and to the same extent as any other water quality standard established under this Act unless the Administrator determines that such standard is inconsistent with the applicable requirements of this Act as in effect immediately prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972. If the Administrator makes such a determination he shall not later than the one hundred and twentieth day after the date of submission of such standards, notify the State and specify the changes needed to meet such requirements. If such changes are not adopted by the State within ninety days after such notification, the Administrator shall promulgate such changes in accordance with subsection (b) of this section.

"(3)(A) Any State which prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972 has not adopted pursuant to its own laws water quality standards applicable to intrastate waters shall, not later than one hundred and eighty days after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, adopt and submit such standards to the Administrator.

"(B) If the Administrator determines that any such standards are consistent with the applicable requirements of this Act as in effect immediately prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, he shall approve such standards.

"(C) If the Administrator determines that any such standards are not consistent with the applicable requirements of this Act as in effect immediately prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, he shall, not later than the ninetieth day after the date of submission of such standards, notify the State and specify the changes to meet such requirements. If such changes are not adopted by the State within ninety days after the date of notification, the Administrator shall promulgate such standards pursuant to subsection (b) of this section.

"(b)(1) The Administrator shall promptly prepare and publish proposed regulations setting forth water quality standards for a State in accordance with the applicable requirements of this Act as in effect immediately prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, if—

"(A) the State fails to submit water quality standards within the times prescribed in subsection (a) of this section,

"(B) a water quality standard submitted by such State under subsection (a) of this section is determined by the Administrator not to be consistent with the applicable requirements of subsection (a) of this section.

"(2) The Administrator shall promulgate any water quality standard published in a proposed regulation not later than one hundred and ninety days after the date he publishes any such proposed standard, unless prior to such promulgation, such State has adopted a water quality standard which the Administrator determines to be in accordance with subsection (a) of this section.

"(c)(1) The Governor of a State or the State water pollution control agency of such State shall from time to time (but at least once each three year period beginning with the date of enactment of the Federal Water Pollution Control Act Amendments of 1972) hold public hearings for the purpose of reviewing applicable water quality standards and, as appropriate, modifying and adopting standards. Results of such review shall be made available to the Administrator.

"(2) Whenever the State revises or adopts a new standard, such revised or new standard shall be submitted to the Administrator. Such revised or new water quality standard shall consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses. Such standards shall be such as to protect the public health or welfare, enhance the quality of water and serve the purposes of this Act. Such standards shall be established taking into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes, and also taking into consideration their use and value for navigation.

"(3) If the Administrator, within sixty days after the date of submission of the revised or new standard, determines that such standard meets the requirements of this Act, such standard shall thereafter be the water quality standard for the applicable waters of that State. If the Administrator determines that any such revised or new standard is not consistent with the applicable requirements of this Act, he shall not later than the ninetieth day after the date of submission of such standard notify the State and specify the changes to meet such requirements. If such changes are not adopted by the State within ninety days after the date of notification, the Administrator shall promulgate such standard pursuant to paragraph (4) of this subsection.

"(4) The Administrator shall promptly prepare and publish proposed regulations setting forth a revised or new water quality standard for the navigable waters involved—

"(A) if a revised or new water quality standard submitted by such State under paragraph (3) of this subsection for such waters is determined by the Administrator not to be consistent with the applicable requirements of this Act, or

"(B) in any case where the Administrator determines that a revised or new standard is necessary to meet the requirements of this Act.

The Administrator shall promulgate any revised or new standard under this paragraph not later than ninety days after he publishes such proposed standards, unless prior to such promulgation, such State has adopted a revised or new water quality standard which the Administrator determines to be in accordance with this Act.

"(d)(1)(A) Each State shall identify those waters within its boundaries for which the effluent limitations required by section 301(b)(1)(A) and section 301(b)(1)(B) are not stringent enough to implement any water quality standard applicable to such waters. The State shall establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters.

"(B) Each State shall identify those waters or parts thereof within its boundaries for which controls on thermal discharges under section 301 are not stringent enough to assure protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife.

"(C) Each State shall establish for the waters identified in paragraph (1)(A) of this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies under section 304(a)(2) as suitable for such calculation. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.

"(D) Each State shall estimate for the waters identified in paragraph (1)(B) of this subsection the total maximum daily thermal load required to assure protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife. Such estimates shall take into account the normal water temperatures, flow rates, seasonal variations, existing sources of heat input, and the dissipative capacity of the identified waters or parts thereof. Such estimates shall include a calculation of the maximum heat input that can be made into each such part and shall include a margin of safety which takes into account any lack of knowledge concerning the development of thermal water quality criteria for such protection and propagation in the identified waters or parts thereof.

"(2) Each State shall submit to the Administrator from time to time, with the first such submission not later than one hundred and eighty days after the date of publication of the first identification of pollutants under section 304(a)(2)(D), for his approval the waters identified and the loads established under paragraphs (1)(A), (1)(B), (1)(C), and (1)(D) of this subsection. The Administrator shall either approve or disapprove such identification and load not later than thirty days after the date of submission. If the Administrator approves such identification and load, such State shall incorporate them into its current plan under subsection (e) of this section. If the Administrator disapproves such identification and load, he shall not later than thirty days after the date of such disapproval identify such waters in such State and establish such loads for such waters as he determines necessary to implement the water quality standards applicable to such waters and upon such identification and establishment the State shall incorporate them into its current plan under subsection (e) of this section.

"(3) For the specific purpose of developing information, each State shall identify all waters within its boundaries which it has not identified under paragraph (1)(A) and (1)(B) of this subsection and estimate for such waters the total maximum daily load with seasonal variations and margins of safety, for those pollutants which the Administrator identifies under section 304(a)(2) as suitable for such calculation and for thermal discharges, at a level that would assure protection and propagation of a balanced indigenous population of fish, shellfish and wildlife.

"(e)(1) Each State shall have a continuing planning process approved under paragraph (2) of this subsection which is consistent with this Act.

"(2) Each State shall submit not later than 120 days after the date of the enactment of the Water Pollution Control Amendments of 1972 to the Administrator for his approval a proposed continuing planning process which is consistent with this Act. Not later than thirty days after the date of submission of such a process the Administrator shall either approve or disapprove such process. The Administrator shall from time to time review each State's approved planning process for the purpose of insuring that such planning process is at all times consistent with this Act. The Administrator shall not approve any State permit program under title IV of this Act for any State which does not have an approved continuing planning process under this section.

"(3) The Administrator shall approve any continuing planning process submitted to him under this section which will result in plans for all navigable waters within such State, which include, but are not limited to, the following:

"(A) effluent limitations and schedules of compliance at least as stringent as those required by section 301(b)(1), section 301(b)(2), section 306, and section 307, and at least as stringent as any requirements contained in any applicable water quality standard in effect under authority of this section;

"(B) the incorporation of all elements of any applicable area-wide waste management plans under section 208, and applicable basin plans under section 209 of this Act;

"(C) total maximum daily load for pollutants in accordance with subsection (d) of this section;

"(D) procedures for revision;

"(E) adequate authority for intergovernmental cooperation;

"(F) adequate implementation, including schedules of compliance, for revised or new water quality standards, under subsection (c) of this section;

"(G) controls over the disposition of all residual waste from any water treatment processing;

"(H) an inventory and ranking, in order of priority, of needs for construction of waste treatment works required to meet the applicable requirements of sections 301 and 302.

"(f) Nothing in this section shall be construed to affect any effluent limitation, or schedule of compliance required by any State to be implemented prior to the dates set forth in sections 301(b)(1) and 301(b)(2) nor to preclude any State from requiring compliance with any effluent limitation or schedule of compliance at dates earlier than such dates.

"(g) Water quality standards relating to heat shall be consistent with the requirements of section 316 of this Act.

"(h) For the purposes of this Act the term 'water quality standards' includes thermal water quality standards.

"INFORMATION AND GUIDELINES

"SEC. 304. (a)(1) The Administrator, after consultation with appropriate Federal and State agencies and other interested persons, shall develop and publish, within one year after the date of enactment of this title (and from time to time thereafter revise) criteria for water quality accurately reflecting the latest scientific knowledge (A) on the kind and extent of all identifiable effects on health and welfare including, but not limited to, plankton, fish, shellfish, wildlife, plant life, shorelines, beaches, esthetics, and recreation which may be expected from the presence of pollutants in any body of water, including ground water; (B) on the concentration and dispersal of pollutants, or their byproducts, through biological, physical, and chemical processes; and (C) on the effects of pollutants on biological community diversity, productivity, and stability, including information on the factors affecting rates of eutrophication and rates of organic and inorganic sedimentation for varying types of receiving waters.

"(2) The Administrator, after consultation with appropriate Federal and State agencies and other interested persons, shall develop and publish, within one year after the date of enactment of this title (and from time to time thereafter revise) information (A) on the factors necessary to restore and maintain the chemical, physical, and biological integrity of all navigable waters, ground waters, waters of the contiguous zone, and the oceans; (B) on the factors necessary for the protection and propagation of shellfish, fish, and wildlife for classes and categories of receiving waters and to allow recreational activities in and on the water; and (C) on the measurement and classification of water quality; and (D) for the purpose of section 303, on and the identification of pollutants suitable for maximum daily load measurement correlated with the achievement of water quality objectives.

"(3) Such criteria and information and revisions thereof shall be issued to the States and shall be published in the Federal Register and otherwise made available to the public.

"(b) For the purpose of adopting or revising effluent limitations under this Act the Administrator shall, after consultation with appropriate Federal and State agencies and other interested persons, publish within one year of enactment of this title, regulations, providing guidelines for effluent limitations, and, at least annually thereafter, revise, if appropriate, such regulations. Such regulations shall—

"(1)(A) identify, in terms of amounts of constituents and chemical, physical, and biological characteristics of pollutants, the degree of effluent reduction attainable through the application of the best practicable control technology currently available for classes and categories of point sources (other than publicly owned treatment works); and

"(B) specify factors to be taken into account in determining the control measures and practices to be applicable to point sources (other than publicly owned treatment works) within such categories or classes. Factors relating to the assessment of best practicable control technology currently available to comply with subsection (b)(1) of section 301 of this Act shall include consideration of the total cost of application of technology in relation to the effluent reduction benefits to be achieved from such application, and shall also take into account the age of equipment and facilities involved, the process employed, the engineering aspects of the application of various types of control techniques, process changes, non-water quality environmental impact (including energy requirements), and such other factors as the Administrator deems appropriate;

"(2)(A) identify, in terms of amounts of constituents and chemical, physical, and biological characteristics of pollutants, the degree of effluent reduction attainable through the application of the best control measures and practices achievable including treatment techniques, process and procedure innovations, operating methods, and other alternatives for classes and categories of point sources (other than publicly owned treatment works); and

"(B) specify factors to be taken into account in determining the best measures and practices available to comply with subsection (b)(2) of section 301 of this Act to be applicable to any point source (other than publicly owned treatment works) within such categories or classes. Factors relating to the assessment of best available technology shall take into account the age of equipment and facilities involved, the process employed, the engineering aspects of the application of various types of control techniques, process changes, the cost of achieving such effluent reduction, non-water quality environmental impact (including energy requirements), and such other factors as the Administrator deems appropriate; and

"(3) identify control measures and practices available to eliminate the discharge of pollutants from categories and classes of point sources, taking into account the cost of achieving such elimination of the discharge of pollutants.

"(c) The Administrator, after consultation, with appropriate Federal and State agencies and other interested persons, shall issue to the States and appropriate water pollution control agencies within 270 days after enactment of this title (and from time to time thereafter) information on the processes, procedures, or operating methods which result in the elimination or reduction of the discharge of pollutants to implement standards of performance under section 306 of this Act. Such information shall include technical and other data, including costs, as are available on alternative methods of elimination or reduction of the discharge of pollutants. Such information, and revisions thereof, shall be published in the Federal Register and otherwise shall be made available to the public.

"(d)(1) The Administrator, after consultation with appropriate Federal and State agencies and other interested persons, shall publish within sixty days after enactment of this title (and from time to time thereafter) information, in terms of amounts of constituents and chemical, physical, and biological characteristics of pollutants, on the degree of effluent reduction attainable through the application of secondary treatment.

"(2) The Administrator, after consultation with appropriate Federal and State agencies and other interested persons, shall publish within nine months after the date of enactment of this title (and from time to time thereafter) information on alternative waste treatment management techniques and systems available to implement section 201 of this Act.

"(e) The Administrator, after consultation with appropriate Federal and State agencies and other interested persons, shall issue to appropriate Federal agencies, the States, water pollution control agencies, and agencies designated under section 208 of this Act, within one year after the effective date of this subsection (and from time to time thereafter) information including (1) guidelines for identifying and evaluating the nature and extent of nonpoint sources of pollutants, and (2) processes, procedures, and methods to control pollution resulting from—

"(A) agricultural and silvicultural activities, including runoff from fields and crop and forest lands;

"(B) mining activities, including runoff and siltation from new, currently operating, and abandoned surface and underground mines;

"(C) all construction activity, including runoff from the facilities resulting from such construction;

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"(D) the disposal of pollutants in wells or in subsurface excavations;

"(E) salt water intrusion resulting from reductions of fresh water flow from any cause, including extraction of ground water, irrigation, obstruction, and diversion; and

"(F) changes in the movement, flow, or circulation of any navigable waters or ground waters, including changes caused by the construction of dams, levees, channels, causeways, or flow diversion facilities.

Such information and revisions thereof shall be published in the Federal Register and otherwise made available to the public.

"(f)(1) For the purpose of assisting States in carrying out programs under section 402 of this Act, the Administrator shall publish, within one hundred and twenty days after the date of enactment of this title, and review at least annually thereafter and, if appropriate, revise guidelines for pretreatment of pollutants which he determines are not susceptible to treatment by publicly owned treatment works. Guidelines under this subsection shall be established to control and prevent the discharge into the navigable waters, the contiguous zone, or the ocean (either directly or through publicly owned treatment works) of any pollutant which interferes with, passes through, or otherwise is incompatible with such works.

"(2) When publishing guidelines under this subsection, the Administrator shall designate the category or categories of treatment works to which the guidelines shall apply.

"(g) The Administrator shall, within one hundred and eighty days from the date of enactment of this title, promulgate guidelines establishing test procedures for the analysis of pollutants that shall include the factors which must be provided in any certification pursuant to section 401 of this Act or permit application pursuant to section 402 of this Act.

"(h) The Administrator shall (1) within sixty days after the enactment of this title promulgate guidelines for the purpose of establishing uniform application forms and other minimum requirements for the acquisition of information from owners and operators of point sources of discharge subject to any State program under section 402 of this Act, and (2) within sixty days from the date of enactment of this title promulgate guidelines establishing the minimum procedural and other elements of any State program under section 402 of this Act which shall include:

"(A) monitoring requirements;

"(B) reporting requirements (including procedures to make information available to the public);

"(C) enforcement provisions; and

"(D) funding, personnel qualifications, and manpower requirements (including a requirement that no board or body which approves permit applications or portions thereof shall include, as a member, any person who receives, or has during the previous two years received, a significant portion of his income directly or indirectly from permit holders or applicants for a permit).

"(i) The Administrator shall, within 270 days after the effective date of this subsection (and from time to time thereafter), issue such information on methods, procedures, and processes as may be appropriate to restore and enhance the quality of the Nation's publicly owned fresh water lakes.

"(j)(1) The Administrator shall, within six months from the date of enactment of this title, enter into agreements with the Secretary of Agriculture, the Secretary of the Army, and the Secretary of the Interior to provide for the maximum utilization of the appropriate programs authorized under other Federal law to be carried out by such Secretaries for the purpose of achieving and maintaining water quality through appropriate implementation of plans approved under section 208 of this Act.

"(2) The Administrator, pursuant to any agreement under paragraph (1) of this subsection is authorized to transfer to the Secretary of Agriculture, the Secretary of the Army, or the Secretary of the Interior any funds appropriated under paragraph (3) of this subsection to supplement any funds otherwise appropriated to carry out appropriate programs authorized to be carried out by such Secretaries.

"(3) There is authorized to be appropriated to carry out the provisions of this subsection, $100,000,000 per fiscal year for the fiscal year ending June 30, 1973, and the fiscal year ending June 30, 1974.

"WATER QUALITY INVENTORY

"SEC. 305. (a) The Administrator, in cooperation with the States and with the assistance of appropriate Federal agencies, shall prepare a report to be submitted to the Congress on or before January 1, 1974, which shall—

"(1) describe the specific quality, during 1973, with appropriate supplemental descriptions as shall be required to take into account seasonal, tidal, and other variations, of all navigable waters and the waters of the contiguous zone;

"(2) include an inventory of all point sources of discharge (based on a qualitative and quantitative analysis of discharges) of pollutants, into all navigable waters and the waters of the contiguous zone; and

"(3) identify specifically those navigable waters, the quality of which—

"(A) is adequate to provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allow recreational activities in and on the water;

"(B) can reasonably be expected to attain such level by 1977 or 1983; and

"(C) can reasonably be expected to attain such level by any later date.

"(b)(1) Each State shall prepare and submit to the Administrator by January 1, 1975, and shall bring up to date each year thereafter, a report which shall include—

"(A) a description of the water quality of all navigable waters in such State during the preceding year, with appropriate supplemental descriptions as shall be required to take into account seasonal, tidal, and other variations, correlated with the quality of water required by the objective of this Act (as identified by the Administrator pursuant to criteria published under section 304(a) of this Act) and the water quality described in subparagraph (B) of this paragraph;

"(B) an analysis of the extent to which all navigable waters of such State provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water;

"(C) an analysis of the extent to which the elimination of the discharge of pollutants and a level of water quality which provides for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allows recreational activities in and on the water, have been or will be achieved by the requirements of this Act, together with recommendations as to additional action necessary to achieve such objectives and for what waters such additional action is necessary;

"(D) an estimate of (i) the environmental impact, (ii) the economic and social costs necessary to achieve the objective of this Act in such State, (iii) the economic and social benefits of such achievement, and (iv) an estimate of the date of such achievement; and

"(E) a description of the nature and extent of nonpoint sources of pollutants, and recommendations as to the programs which must be undertaken to control each category of such sources, including an estimate of the costs of implementing such programs.

"(2) The Administrator shall transmit such State reports, together with an analysis thereof, to Congress on or before October 1, 1975, and annually thereafter.

"NATIONAL STANDARDS OF PERFORMANCE

"SEC. 306. (a) For purposes of this section:

"(1) The term 'standard of performance' means a standard for the control of the discharge of pollutants which reflects the greatest degree of effluent reduction which the Administrator determines to be achievable through application of the best available demonstrated control technology, processes, operating methods, or other alternatives, including, where practicable, a standard permitting no discharge of pollutants.

"(2) The term 'new source' means any source, the construction of which is commenced after the publication of proposed regulations prescribing a standard of performance under this section which will be applicable to such source, if such standard is thereafter promulgated in accordance with this section.

"(3) The term 'source' means any building, structure, facility, or installation from which there is or may be the discharge of pollutants.

"(4) The term 'owner or operator' means any person who owns, leases, operates, controls, or supervises a source.

"(5) The term 'construction' means any placement, assembly, or installation of facilities or equipment (including contractual obligations to purchase such facilities or equipment) at the premises where such equipment will be used, including preparation work at such premises.

"(b)(1)(A) The Administrator shall, within ninety days after the date of enactment of this title publish (and from time to time thereafter shall revise) a list of categories of sources, which shall, at the minimum, include:

"pulp and paper mills;
"paperboard, builders paper and board mills;
"meat product and rendering processing;
"dairy product processing;
"grain mills;
"canned and preserved fruits and vegetables processing;
"canned and preserved seafood processing;
"sugar processing;
"textile mills;
"cement manufacturing;
"feedlots;
"electroplating;
"organic chemicals manufacturing;
"inorganic chemicals manufacturing;

"plastic and synthetic materials manufacturing;
"soap and detergent manufacturing;
"fertilizer manufacturing;
"petroleum refining;
"iron and steel manufacturing;
"nonferrous metals manufacturing;
"phosphate manufacturing;
"steam electric powerplants;
"ferroalloy manufacturing;
"leather tanning and finishing;
"glass and asbestos manufacturing;
"rubber processing; and
"timber products processing.

"(B) As soon as practicable, but in no case more than one year, after a category of sources is included in a list under subparagraph (A) of this paragraph, the Administrator shall propose and publish regulations establishing Federal standards of performance for new sources within such category. The Administrator shall afford interested persons an opportunity for written comment on such proposed regulations. After considering such comments, he shall promulgate, within one hundred and twenty days after publication of such proposed regulations, such standards with such adjustments as he deems appropriate. The Administrator shall, from time to time, as technology and alternatives change, revise such standards following the procedure required by this subsection for promulgation of such standards. Standards of performance, or revisions thereof, shall become effective upon promulgation. In establishing or revising Federal standards of performance for new sources under this section, the Administrator shall take into consideration the cost of achieving such effluent reduction, and any non-water quality environmental impact and energy requirements.

"(2) The Administrator may distinguish among classes, types, and sizes within categories of new sources for the purpose of establishing such standards and shall consider the type of process employed (including whether batch or continuous).

"(3) The provisions of this section shall apply to any new source owned or operated by the United States.

"(c) Each State may develop and submit to the Administrator a procedure under State law for applying and enforcing standards of performance for new sources located in such State. If the Administrator finds that the procedure and the law of any State require the application and enforcement of standards of performance to at least the same extent as required by this section, such State is authorized to apply and enforce such standards of performance (except with respect to new sources owned or operated by the United States).

"(d) Notwithstanding any other provision of this Act, any point source the construction of which is commenced after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972 and which is so constructed as to meet all applicable standards of performance shall not be subject to any more stringent standard of performance during a ten-year period beginning on the date of completion of such construction or during the period of depreciation or amortization of such facility for the purposes of section 167 or 169 (or both) of the Internal Revenue Code of 1954, whichever period ends first.

"(e) After the effective date of standards of performance promulgated under this section, it shall be unlawful for any owner or operator of any new source to operate such source in violation of any standard of performance applicable to such source.

"TOXIC AND PRETREATMENT EFFLUENT STANDARDS

"SEC. 307. (a)(1) The Administrator shall, within ninety days after the date of enactment of this title, publish (and from time to time thereafter revise) a list which includes any toxic pollutant or combination of such pollutants for which an effluent standard (which may include a prohibition of the discharge of such pollutants or combination of such pollutants) will be established under this section. The Administrator in publishing such list shall take into account the toxicity of the pollutant, its persistence, degradability, the usual or potential presence of the affected organisms in any waters, the importance of the affected organisms and the nature and extent of the effect of the toxic pollutant on such organisms.

"(2) Within one hundred and eighty days after the date of publication of any list, or revision thereof, containing toxic pollutants or combination of pollutants under paragraph (1) of this subsection, the Administrator, in accordance with section 553 of title 5 of the United States Code, shall publish a proposed effluent standard (or a prohibition) for such pollutant or combination of pollutants which shall take into account the toxicity of the pollutant, its persistence, degradability, the usual or potential presence of the affected organisms in any waters, the importance of the affected organisms and the nature and extent of the effect of the toxic pollutant on such organisms, and he shall publish a notice for a public hearing on such proposed standard to be held within thirty days. As soon as possible after such hearing, but not later than six months after publication of the proposed effluent standard (or prohibition), unless the Administrator finds, on the record, that a modification of such proposed standard (or prohibition) is justified based upon a preponderance of evidence adduced at such hearings, such standard (or prohibition) shall be promulgated.

"(3) If after a public hearing the Administrator finds that a modification of such proposed standard (or prohibition) is justified, a revised effluent standard (or prohibition) for such pollutant or combination of pollutants shall be promulgated immediately. Such standard (or prohibition) shall be reviewed and, if appropriate, revised at least every three years.

"(4) Any effluent standard promulgated under this section shall be at that level which the Administrator determines provides an ample margin of safety.

"(5) When proposing or promulgating any effluent standard (or prohibition) under this section, the Administrator shall designate the category or categories of sources to which the effluent standard (or prohibition) shall apply. Any disposal of dredged material may be included in such a category of sources after consultation with the Secretary of the Army.

"(6) Any effluent standard (or prohibition) established pursuant to this section shall take effect on such date or dates as specified in the order promulgating such standard, but in no case more than one year from the date of such promulgation.

"(7) Prior to publishing any regulations pursuant to this section the Administrator shall, to the maximum extent practicable within the time provided, consult with appropriate advisory committees, States, independent experts, and Federal departments and agencies.

"(b)(1) The Administrator shall, within one hundred and eighty days after the date of enactment of this title and from time to time thereafter, publish proposed regulations establishing pretreatment standards for introduction of pollutants into treatment works (as defined in section 212 of this Act) which are publicly owned for those pollutants which are determined not to be susceptible to treatment by such treatment works or which would interfere with the operation of such treatment works. Not later than ninety days after such publication, and after opportunity for public hearing, the Administrator shall promulgate such pretreatment standards. Pretreatment standards under this subsection shall specify a time for compliance not to exceed three years from the date of promulgation and shall be established to prevent the discharge of any pollutant through treatment works (as defined in section 212 of this Act) which are publicly owned, which pollutant interferes with, passes through, or otherwise is incompatible with such works.

"(2) The Administrator shall, from time to time, as control technology, processes, operating methods, or other alternatives change, revise such standards following the procedure established by this subsection for promulgation of such standards.

"(3) When proposing or promulgating any pretreatment standard under this section, the Administrator shall designate the category or categories of sources to which such standard shall apply.

"(4) Nothing in this subsection shall affect any pretreatment requirement established by any State or local law not in conflict with any pretreatment standard established under this subsection.

"(c) In order to insure that any source introducing pollutants into a publicly owned treatment works, which source would be a new source subject to section 306 if it were to discharge pollutants, will not cause a violation of the effluent limitations established for any such treatment works, the Administrator shall promulgate pretreatment standards for the category of such sources simultaneously with the promulgation of standards of performance under section 306 for the equivalent category of new sources. Such pretreatment standards shall prevent the discharge of any pollutant into such treatment works, which pollutant may interfere with, pass through, or otherwise be incompatible with such works.

"(d) After the effective date of any effluent standard or prohibition or pretreatment standard promulgated under this section, it shall be unlawful for any owner or operator of any source to operate any source in violation of any such effluent standard or prohibition or pretreatment standard.

"INSPECTIONS, MONITORING AND ENTRY

"SEC. 308. (a) Whenever required to carry out the objective of this Act, including but not limited to (1) developing or assisting in the development of any effluent limitation, or other limitation, prohibition, or effluent standard, pretreatment standard, or standard of performance under this Act; (2) determining whether any person is in violation of any such effluent limitation, or other limitation, prohibition or effluent standard, pretreatment standard, or standard of performance; (3) any requirement established under this section; or (4) carrying out sections 305, 311, 402, and 504 of this Act—

"(A) the Administrator shall require the owner or operator of any point source to (i) establish and maintain such records, (ii) make such reports, (iii) install, use, and maintain such monitoring equipment or methods (including where appropriate, biological monitoring methods), (iv) sample such effluents (in accordance with such methods, at such locations, at such intervals, and in such manner as the Administrator shall prescribe), and (v) provide such other information as he may reasonably require; and

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"(B) the Administrator or his authorized representative, upon presentation of his credentials—

"(i) shall have a right of entry to, upon, or through any premises in which an effluent source is located or in which any records required to be maintained under clause (A) of this subsection are located, and

"(ii) may at reasonable times have access to and copy any records, inspect any monitoring equipment or method required under clause (A), and sample any effluents which the owner or operator of such source is required to sample under such clause.

"(b) Any records, reports, or information obtained under this section (1) shall, in the case of effluent data, be related to any applicable effluent limitations, toxic, pretreatment, or new source performance standards, and (2) shall be available to the public, except that upon a showing satisfactory to the Administrator by any person that records, reports, or information, or particular part thereof (other than effluent data), to which the Administrator has access under this section, if made public would divulge methods or processes entitled to protection as trade secrets of such person, the Administrator shall consider such record, report, or information, or particular portion thereof confidential in accordance with the purposes of section 1905 of title 18 of the United States Code, except that such record, report, or information may be disclosed to other officers, employees, or authorized representatives of the United States concerned with carrying out this Act or when relevant in any proceeding under this Act.

"(c) Each State may develop and submit to the Administrator procedures under State law for inspection, monitoring, and entry with respect to point sources located in such State. If the Administrator finds that the procedures and the law of any State relating to inspection, monitoring, and entry are applicable to at least the same extent as those required by this section, such State is authorized to apply and enforce its procedures for inspection, monitoring, and entry with respect to point sources located in such State (except with respect to point sources owned or operated by the United States).

"FEDERAL ENFORCEMENT

"SEC. 309. (a)(1) Whenever, on the basis of any information available to him, the Administrator finds that any person is in violation of any condition or limitation which implements section 301, 302, 306, 307, or 308 of this Act in a permit issued by a State under an approved permit program under section 402 of this Act, he shall proceed under his authority in paragraph (3) of this subsection or he shall notify the person in alleged violation and such State of such finding. If beyond the thirtieth day after the Administrator's notification the State has not commenced appropriate enforcement action, the Administrator shall issue an order requiring such person to comply with such condition or limitation or shall bring a civil action in accordance with subsection (b) of this section.

"(2) Whenever, on the basis of information available to him, the Administrator finds that violations of permit conditions or limitations as set forth in paragraph (1) of this subsection are so widespread that such violations appear to result from a failure of the State to enforce such permit conditions or limitations effectively, he shall so notify the State. If the Administrator finds such failure extends beyond the thirtieth day after such notice, he shall give public notice of such finding. During the period beginning with such public notice and ending when such State satisfies the Administrator that it will enforce such conditions and limitations (hereafter referred to in this section as the period of 'federally assumed enforcement'), the Administrator shall enforce any permit condition or limitation with respect to any person—

"(A) by issuing an order to comply with such condition or limitation, or

"(B) by bringing a civil action under subsection (b) of this section.

"(3) Whenever on the basis of any information available to him the Administrator finds that any person is in violation of section 301, 302, 306, 307, or 308 of this Act, or is in violation of any permit condition or limitation implementing any of such sections in a permit issued under section 402 of this Act by him or by a State, he shall issue an order requiring such person to comply with such section or requirement, or he shall bring a civil action in accordance with subsection (b) of this section.

"(4) A copy of any order issued under this subsection shall be sent immediately by the Administrator to the State in which the violation occurs and other affected States. Any order issued under this subsection shall be by personal service and shall state with reasonable specificity the nature of the violation, specify a time for compliance, not to exceed thirty days, which the Administrator determines is reasonable, taking into account the seriousness of the violation and any good faith efforts to comply with applicable requirements. In any case in which an order under this subsection (or notice to a violator under paragraph (1) of this subsection) is issued to a corporation, a copy of such order (or notice) shall be served on any appropriate corporate officers. An order issued under this subsection relating to a violation of section 308 of this Act shall not take effect until the person to whom it is issued has had an opportunity to confer with the Administrator concerning the alleged violation.

"(b) The Administrator is authorized to commence a civil action for appropriate relief, including a permanent or temporary injunction, for any violation for which he is authorized to issue a compliance order under subsection (a) of this section. Any action under this subsection may be brought in the district court of the United States for the district in which the defendant is located or resides or is doing business, and such court shall have jurisdiction to restrain such violation and to require compliance. Notice of the commencement of such action shall be given immediately to the appropriate State.

"(c)(1) Any person who willfully or negligently violates section 301, 302, 306, 307, or 308 of this Act, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of this Act by the Administrator or by a State, shall be punished by a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than one year, or by both. If the conviction is for a violation committed after a first conviction of such person under this paragraph, punishment shall be by a fine of not more than $50,000 per day of violation, or by imprisonment for not more than two years, or by both.

"(2) Any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under this Act or who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this Act, shall upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than six months, or by both.

"(3) For the purposes of this subsection, the term 'person' shall mean, in addition to the definition contained in section 502(5) of this Act, any responsible corporate officer.

"(d) Any person who violates section 301, 302, 306, 307, or 308 of this Act, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of this Act by the Administrator, or by a State, and any person who violates any order issued by the Administrator under subsection (a) of this section, shall be subject to a civil penalty not to exceed $10,000 per day of such violation.

"(e) Whenever a municipality is a party to a civil action brought by the United States under this section, the State in which such municipality is located shall be joined as a party. Such State shall be liable for payment of any judgment, or any expenses incurred as a result of complying with any judgment, entered against the municipality in such action to the extent that the laws of that State prevent the municipality from raising revenues needed to comply with such judgment.

"INTERNATIONAL POLLUTION ABATEMENT

"SEC. 310. (a) Whenever the Administrator, upon receipts of reports, surveys, or studies from any duly constituted international agency, has reason to believe that pollution is occurring which endangers the health or welfare of persons in a foreign country, and the Secretary of State requests him to abate such pollution, he shall give formal notification thereof to the State water pollution control agency of the State or States in which such discharge or discharges originate and to the appropriate interstate agency, if any. He shall also promptly call such a hearing, if he believes that such pollution is occurring in sufficient quantity to warrant such action, and if such foreign country has given the United States essentially the same rights with respect to the prevention and control of pollution occurring in that country as is given that country by this subsection. The Administrator, through the Secretary of State, shall invite the foreign country which may be adversely affected by the pollution to attend and participate in the hearing, and the representative of such country shall, for the purpose of the hearing and any further proceeding resulting from such hearing, have all the rights of a State water pollution control agency. Nothing in this subsection shall be construed to modify, amend, repeal, or otherwise affect the provisions of the 1909 Boundary Waters Treaty between Canada and the United States or the Water Utilization Treaty of 1944 between Mexico and the United States (59 Stat. 1219), relative to the control and abatement of pollution in waters covered by those treaties.

"(b) The calling of a hearing under this section shall not be construed by the courts, the Administrator, or any person as limiting, modifying, or otherwise affecting the functions and responsibilities of the Administrator under this section to establish and enforce water quality requirements under this Act.

"(c) The Administrator shall publish in the Federal Register a notice of a public hearing before a hearing board of five or more persons appointed by the Administrator. A majority of the members of the board and the chairman who shall be designated by the Administrator shall not be officers or employees of Federal, State, or local governments. On the basis of the evidence presented at such hearing, the board shall within sixty days after completion of the hearing make findings of fact as to whether or not such pollution is occurring and shall thereupon by decision, incorporating its findings therein, make such recommendations to abate the pollution as

may be appropriate and shall transmit such decision and the record of the hearings to the Administrator. All such decisions shall be public. Upon receipt of such decision, the Administrator shall promptly implement the board's decision in accordance with the provisions of this Act.

"(d) In connection with any hearing called under this subsection, the board is authorized to require any person whose alleged activities result in discharges causing or contributing to pollution to file with it in such forms as it may prescribe, a report based on existing data, furnishing such information as may reasonably be required as to the character, kind, and quantity of such discharges and the use of facilities or other means to prevent or reduce such discharges by the person filing such a report. Such report shall be made under oath or otherwise, as the board may prescribe, and shall be filed with the board within such reasonable period as it may prescribe, unless additional time is granted by it. Upon a showing satisfactory to the board by the person filing such report that such report or portion thereof (other than effluent data), to which the Administrator has access under this section, if made public would divulge trade secrets or secret processes of such person, the board shall consider such report or portion thereof confidential for the purposes of section 1905 of title 18 of the United States Code. If any person required to file any report under this paragraph shall fail to do so within the time fixed by the board for filing the same, and such failure shall continue for thirty days after notice of such default, such person shall forfeit to the United States the sum of $1,000 for each and every day of the continuance of such failure, which forfeiture shall be payable into the Treasury of the United States, and shall be recoverable in a civil suit in the name of the United States in the district court of the United States where such person has his principal office or in any district in which he does business. The Administrator may upon application therefor remit or mitigate any forfeiture provided for under this subsection.

"(e) Board members, other than officers or employees of Federal, State, or local governments, shall be for each day (including traveltime) during which they are performing board business, entitled to receive compensation at a rate fixed by the Administrator but not in excess of the maximum rate of pay for grade GS–18, as provided in the General Schedule under section 5332 of title 5 of the United States Code, and shall, notwithstanding the limitations of sections 5703 and 5704 of title 5 of the United States Code, be fully reimbursed for travel, subsistence, and related expenses.

"(f) When any such recommendation adopted by the Administrator involves the institution of enforcement proceedings against any person to obtain the abatement of pollution subject to such recommendation, the Administrator shall institute such proceedings if he believes that the evidence warrants such proceedings. The district court of the United States shall consider and determine de novo all relevant issues, but shall receive in evidence the record of the proceedings before the conference or hearing board. The court shall have jurisdiction to enter such judgment and orders enforcing such judgment as it deems appropriate or to remand such proceedings to the Administrator for such further action as it may direct.

"OIL AND HAZARDOUS SUBSTANCE LIABILITY

"SEC. 311. (a) For the purpose of this section, the term—

"(1) 'oil' means oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil;

"(2) 'discharge' includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying or dumping;

"(3) 'vessel' means every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water other than a public vessel;

"(4) 'public vessel' means a vessel owned or bareboat-chartered and operated by the United States, or by a State or political subdivision thereof, or by a foreign nation, except when such vessel is engaged in commerce;

"(5) 'United States' means the States, the District of Columbia, the Commonwealth of Puerto Rico, the Canal Zone, Guam, American Samoa, the Virgin Islands, and the Trust Territory of the Pacific Islands;

"(6) 'owner or operator' means (A) in the case of a vessel, any person owning, operating, or chartering by demise, such vessel, and (B) in the case of an onshore facility, and an offshore facility, any person owning or operating such onshore facility or offshore facility, and (C) in the case of any abandoned offshore facility, the person who owned or operated such facility immediately prior to such abandonment;

"(7) 'person' includes an individual, firm, corporation, association, and a partnership;

"(8) 'remove' or 'removal' refers to removal of the oil or hazardous substances from the water and shorelines or the taking of such other actions as may be necessary to minimize or mitigate damage to the public health or welfare, including, but not limited to, fish, shellfish, wildlife, and public and private property, shorelines, and beaches;

"(9) 'contiguous zone' means the entire zone established or to be established by the United States under article 24 of the Convention on the Territorial Sea and the Contiguous Zone;

"(10) 'onshore facility' means any facility (including, but not limited to, motor vehicles and rolling stock) of any kind located in, on, or under, any land within the United States other than submerged land;

"(11) 'offshore facility' means any facility of any kind located in, on, or under, any of the navigable waters of the United States other than a vessel or a public vessel;

"(12) 'act of God' means an act occasioned by an unanticipated grave natural disaster;

"(13) 'barrel' means 42 United States gallons at 60 degrees Fahrenheit;

"(14) 'hazardous substance' means any substance designated pursuant to subsection (b)(2) of this section.

"(b)(1) The Congress hereby declares that it is the policy of the United States that there should be no discharges of oil or hazardous substances into or upon the navigable waters of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone.

"(2)(A) The Administrator shall develop, promulgate, and revise as may be appropriate, regulations designating as hazardous substances, other than oil as defined in this section, such elements and compounds which, when discharged in any quantity into or upon the navigable waters of the United States or adjoining shorelines or the waters of the contiguous zone, present an imminent and substantial danger to the public health or welfare, including, but not limited to, fish, shellfish, wildlife, shorelines, and beaches.

"(B)(i) The Administrator shall include in any designation under subparagraph (A) of this subsection a determination whether any such designated hazardous substance can actually be removed.

"(ii) The owner or operator of any vessel, onshore facility, or offshore facility from which there is discharged during the two-year period beginning on the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, any hazardous substance determined not removable under clause (i) of this subparagraph shall be liable, subject to the defenses to liability provided under subsection (f) of this section, as appropriate, to the United States for a civil penalty per discharge established by the Administrator based on toxicity, degradability, and dispersal characteristics of such substance, in an amount not to exceed $50,000, except that where the United States can show that such discharge was a result of willful negligence or willful misconduct within the privity and knowledge of the owner, such owner or operator shall be liable to the United States for a civil penalty in such amount as the Administrator shall establish, based upon the toxicity, degradability, and dispersal characteristics of such substance.

"(iii) After the expiration of the two-year period referred to in clause (ii) of this subparagraph, the owner or operator of any vessel, onshore facility, or offshore facility, from which there is discharged any hazardous substance determined not removable under clause (i) of this subparagraph shall be liable, subject to the defenses to liability provided in subsection (f) of this section, to the United States for either one or the other of the following penalties, the determination of which shall be in the discretion of the Administrator:

"(aa) a penalty in such amount as the Administrator shall establish, based on the toxicity, degradability, and dispersal characteristics of the substance, but not less than $500 nor more than $5,000; or

"(bb) a penalty determined by the number of units discharged multiplied by the amount established for such unit under clause (iv) of this subparagraph, but such penalty shall not be more than $5,000,000 in the case of a discharge from a vessel and $500,000 in the case of a discharge from an onshore or offshore facility.

"(iv) The Administrator shall establish by regulation, for each hazardous substance designated under subparagraph (A) of this paragraph, and within 180 days of the date of such designation, a unit of measurement based upon the usual trade practice and, for the purpose of determining the penalty under clause (iii)(bb) of this subparagraph, shall establish for each such unit a fixed monetary amount which shall be not less than $100 nor more than $1,000 per unit. He shall establish such fixed amount based on the toxicity, degradability, and dispersal characteristics of the substance.

"(3) The discharge of oil or hazardous substances into or upon the navigable waters of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone in harmful quantities as determined by the President under paragraph (4) of this subsection, is prohibited, except (A) in the case of such discharges of oil into the waters of the contiguous zone, where permitted under article IV of the International Convention for the Prevention of Pollution of the Sea by Oil, 1954, as amended, and (B) where permitted in quantities and at times and locations or under such circumstances or conditions as the President may, by regulation, determine not to be harmful. Any regulations issued under this subsection shall be consistent with maritime safety and with marine and navigation laws and regulations and applicable water quality standards.

"(4) The President shall by regulation, to be issued as soon as possi-

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ble after the date of enactment of this paragraph, determine for the purposes of this section, those quantities of oil and any hazardous substance the discharge of which, at such times, locations, circumstances, and conditions, will be harmful to the public health or welfare of the United States, including, but not limited to, fish, shellfish, wildlife, and public and private property, shorelines, and beaches except that in the case of the discharge of oil into or upon the waters of the contiguous zone, only those discharges which threaten the fishery resources of the contiguous zone or threaten to pollute or contribute to the pollution of the territory or the territorial sea of the United States may be determined to be harmful.

"(5) Any person in charge of a vessel or of an onshore facility or an offshore facility shall, as soon as he has knowledge of any discharge of oil or a hazardous substance from such vessel or facility in violation of paragraph (3) of this subsection, immediately notify the appropriate agency of the United States Government of such discharge. Any such person who fails to notify immediately such agency of such discharge shall, upon conviction, be fined not more than $10,000, or imprisoned for not more than one year, or both. Notification received pursuant to this paragraph or information obtained by the exploitation of such notification shall not be used against any such person in any criminal case, except a prosecution for perjury or for giving a false statement.

"(6) Any owner or operator of any vessel, onshore facility, or offshore facility from which oil or a hazardous substance is discharged in violation of paragraph (3) of this subsection shall be assessed a civil penalty by the Secretary of the department in which the Coast Guard is operating of not more than $5,000 for each offense. No penalty shall be assessed unless the owner or operator charged shall have been given notice and opportunity for a hearing on such charge. Each violation is a separate offense. Any such civil penalty may be compromised by such Secretary. In determining the amount of the penalty, or the amount agreed upon in compromise, the appropriateness of such penalty to the size of the business of the owner or operator charged, the effect on the owner or operator's ability to continue in business, and the gravity of the violation, shall be considered by such Secretary. The Secretary of the Treasury shall withhold at the request of such Secretary the clearance required by section 4197 of the Revised Statutes of the United States, as amended (46 U.S.C. 91), of any vessel the owner or operator of which is subject to the foregoing penalty. Clearance may be granted in such cases upon the filing of a bond or other surety satisfactory to such Secretary.

"(c)(1) Whenever any oil or a hazardous substance is discharged, into or upon the navigable waters of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone, the President is authorized to act to remove or arrange for the removal of such oil or substance at any time, unless he determines such removal will be done properly by the owner or operator of the vessel, onshore facility, or offshore facility from which the discharge occurs.

"(2) Within sixty days after the effective date of this section, the President shall prepare and publish a National Contingency Plan for removal of oil and hazardous substances, pursuant to this subsection. Such National Contingency Plan shall provide for efficient, coordinated, and effective action to minimize damage from oil and hazardous substance discharges, including containment, dispersal, and removal of oil and hazardous substances, and shall include, but not be limited to—

"(A) assignment of duties and responsibilities among Federal departments and agencies in coordination with State and local agencies, including, but not limited to, water pollution control, conservation, and port authorities;

"(B) identification, procurement, maintenance, and storage of equipment and supplies;

"(C) establishment or designation of a strike force consisting of personnel who shall be trained, prepared, and available to provide necessary services to carry out the Plan, including the establishment at major ports, to be determined by the President, of emergency task forces of trained personnel, adequate oil and hazardous substance pollution control equipment and material, and a detailed oil and hazardous substance pollution prevention and removal plan;

"(D) a system of surveillance and notice designed to insure earliest possible notice of discharges of oil and hazardous substances to the appropriate Federal agency;

"(E) establishment of a national center to provide coordination and direction for operations in carrying out the Plan;

"(F) procedures and techniques to be employed in identifying, containing, dispersing, and removing oil and hazardous substances;

"(G) a schedule, prepared in cooperation with the States, identifying (i) dispersants and other chemicals, if any, that may be used in carrying out the Plan, (ii) the waters in which such dispersants and chemicals may be used, and (iii) the quantities of such dispersant or chemical which can be used safely in such waters, which schedule shall provide in the case of any dispersant, chemical, or waters not specifically identified in such schedule that the President, or his delegate, may, on a case-by-case basis, identify the dispersants and other chemicals which may be used, the waters in which they may be used, and the quantities which can be used safely in such waters; and

"(H) a system whereby the State or States affected by a discharge of oil or hazardous substance may act where necessary to remove such discharge and such State or States may be reimbursed from the fund established under subsection (k) of this section for the reasonable costs incurred in such removal.

The President may, from time to time, as he deems advisable revise or otherwise amend the National Contingency Plan. After publication of the National Contingency Plan, the removal of oil and hazardous substances and actions to minimize damage from oil and hazardous substance discharges shall, to the greatest extent possible, be in accordance with the National Contingency Plan.

"(d) Whenever a marine disaster in or upon the navigable waters of the United States has created a substantial threat of a pollution hazard to the public health or welfare of the United States, including, but not limited to, fish, shellfish, and wildlife and the public and private shorelines and beaches of the United States, because of a discharge, or an imminent discharge, of large quantities of oil, or of a hazardous substance from a vessel the United States may (A) coordinate and direct all public and private efforts directed at the removal or elimination of such threat; and (B) summarily remove, and, if necessary, destroy such vessel by whatever means are available without regard to any provisions of law governing the employment of personnel or the expenditure of appropriated funds. Any expense incurred under this subsection shall be a cost incurred by the United States Government for the purposes of subsection (f) in the removal of oil or hazardous substance.

"(e) In addition to any other action taken by a State or local government, when the President determines there is an imminent and substantial threat to the public health or welfare of the United States, including, but not limited to, fish, shellfish, and wildlife and public and private property, shorelines, and beaches within the United States, because of an actual or threatened discharge of oil or hazardous substance into or upon the navigable waters of the United States from an onshore or offshore facility, the President may require the United States attorney of the district in which the threat occurs to secure such relief as may be necessary to abate such threat, and the district courts of the United States shall have jurisdiction to grant such relief as the public interest and the equities of the case may require.

"(f)(1) Except where an owner or operator can prove that a discharge was caused solely by (A) an act of God, (B) an act of war, (C) negligence on the part of the United States Government, or (D) an act or omission of a third party without regard to whether any such act or omission was or was not negligent, or any combination of the foregoing clauses, such owner or operator of any vessel from which oil or a hazardous substance is discharged in violation of subsection (b) (3) of this section shall, notwithstanding any other provision of law, be liable to the United States Government for the actual costs incurred under subsection (c) for the removal of such oil or substance by the United States Government in an amount not to exceed $100 per gross ton of such vessel or $14,000,000, whichever is lesser, except that where the United States can show that such discharge was the result of willful negligence or willful misconduct within the privity and knowledge of the owner, such owner or operator shall be liable to the United States Government for the full amount of such costs. Such costs shall constitute a maritime lien on such vessel which may be recovered in an action in rem in the district court of the United States for any district within which any vessel may be found. The United States may also bring an action against the owner or operator of such vessel in any court of competent jurisdiction to recover such costs.

"(2) Except where an owner or operator of an onshore facility can prove that a discharge was caused solely by (A) an act of God, (B) an act of war, (C) negligence on the part of the United States Government, or (D) an act or omission of a third party without regard to whether any such act or omission was or was not negligent, or any combination of the foregoing clauses, such owner or operator of any such facility from which oil or a hazardous substance is discharged in violation of subsection (b) (3) of this section shall be liable to the United States Government for the actual costs incurred under subsection (c) for the removal of such oil or substance by the United States Government in an amount not to exceed $8,000,000, except that where the United States can show that such discharge was the result of willful negligence or willful misconduct within the privity and knowledge of the owner, such owner or operator shall be liable to the United States Government for the full amount of such costs. The United States may bring an action against the owner or operator of such facility in any court of competent jurisdiction to recover such costs. The Administrator is authorized, by regulation, after consultation with the Secretary of Commerce and the Small Business Administration, to establish reasonable and equitable classifications of those onshore facilities having a total fixed storage capacity of 1,000 barrels or less which he determines because of size, type, and location do not present a substantial risk of the discharge of oil or a hazardous substance in violation of subsection (b) (3) of this section, and apply with respect to such classifica-

tions differing limits of liability which may be less than the amount contained in this paragraph.

"(3) Except where an owner or operator of an offshore facility can prove that a discharge was caused solely by (A) an act of God, (B) an act of war, (C) negligence on the part of the United States Government, or (D) an act or omission of a third party without regard to whether any such act or omission was or was not negligent, or any combination of the foregoing clauses, such owner or operator of any such facility from which oil or a hazardous substance is discharged in violation of subsection (b)(3) of this section shall, notwithstanding any other provision of law, be liable to the United States Government for the actual costs incurred under subsection (c) for the removal of such oil or substance by the United States Government in an amount not to exceed $8,000,000, except that where the United States can show that such discharge was the result of willful negligence or willful misconduct within the privity and knowledge of the owner, such owner or operator shall be liable to the United States Government for the full amount of such costs. The United States may bring an action against the owner or operator of such a facility in any court of competent jurisdiction to recover such costs.

"(g) In any case where an owner or operator of a vessel, of an onshore facility, or of an offshore facility, from which oil or a hazardous substance is discharged in violation of subsection (b)(3) of this section, proves that such discharge of oil or hazardous substance was caused solely by an act or omission of a third party, or was caused solely by such an act or omission in combination with an act of God, an act of war, or negligence on the part of the United States Government, such third party shall, notwithstanding any other provision of law, be liable to the United States Government for the actual costs incurred under subsection (c) for removal of such oil or substance by the United States Government, except where such third party can prove that such discharge was caused solely by (A) an act of God, (B) an act of war, (C) negligence on the part of the United States Government, or (D) an act or omission of another party without regard to whether such act or omission was or was not negligent, or any combination of the foregoing clauses. If such third party was the owner or operator of a vessel which caused the discharge of oil or a hazardous substance in violation of subsection (b)(3) of this section, the liability of such third party under this subsection shall not exceed $100 per gross ton of such vessel or $14,000,000, whichever is the lesser. In any other case the liability of such third party shall not exceed the limitation which would have been applicable to the owner or operator of the vessel or the onshore or offshore facility from which the discharge actually occurred if such owner or operator were liable. If the United States can show that the discharge of oil or a hazardous substance in violation of subsection (b)(3) of this section was the result of willful negligence or willful misconduct within the privity and knowledge of such third party, such third party shall be liable to the United States Government for the full amount of such removal costs. The United States may bring an action against the third party in any court of competent jurisdiction to recover such removal costs.

"(h) The liabilities established by this section shall in no way affect any rights which (1) the owner or operator of a vessel or of an onshore facility or an offshore facility may have against any third party whose acts may in any way have caused or contributed to such discharge, or (2) The United States Government may have against any third party whose actions may in any way have caused or contributed to the discharge of oil or hazardous substance.

"(i)(1) In any case where an owner or operator of a vessel or an onshore facility or an offshore facility from which oil or a hazardous substance is discharged in violation of subsection (b)(3) of this section acts to remove such oil or substance in accordance with regulations promulgated pursuant to this section, such owner or operator shall be entitled to recover the reasonable costs incurred in such removal upon establishing, in a suit which may be brought against the United States Government in the United States Court of Claims, that such discharge was caused solely by (A) an act of God, (B) an act of war, (C) negligence on the part of the United States Government, or (D) an act or omission of a third party without regard to whether such act or omission was or was not negligent, or of any combination of the foregoing causes.

"(2) The provisions of this subsection shall not apply in any case where liability is established pursuant to the Outer Continental Shelf Lands Act.

"(3) Any amount paid in accordance with a judgment of the United States Court of Claims pursuant to this section shall be paid from the funds established pursuant to subsection (k).

"(j)(1) Consistent with the National Contingency Plan required by subsection (c)(2) of this section, as soon as practicable after the effective date of this section, and from time to time thereafter, the President shall issue regulations consistent with maritime safety and with marine and navigation laws (A) establishing methods and procedures for removal of discharged oil and hazardous substances, (B) establishing criteria for the development and implementation of local and regional oil and hazardous substance removal contingency plans, (C) establishing procedures, methods, and equipment and other requirements for equipment to prevent discharges of oil and hazardous substances from vessels and from onshore facilities and offshore facilities, and to contain such discharges, and (D) governing the inspection of vessels carrying cargoes of oil and hazardous substances and the inspection of such cargoes in order to reduce the likelihood of discharges of oil from vessels in violation of this section.

"(2) Any owner or operator of a vessel or an onshore facility or an offshore facility and any other person subject to any regulation issued under paragraph (1) of this subsection who fails or refuses to comply with the provisions of any such regulations, shall be liable to a civil penalty of not more than $5,000 for each such violation. Each violation shall be a separate offense. The President may assess and compromise such penalty. No penalty shall be assessed until the owner, operator, or other person charged shall have been given notice and an opportunity for a hearing on such charge. In determining the amount of the penalty, or the amount agreed upon in compromise, the gravity of the violation, and the demonstrated good faith of the owner, operator, or other person charged in attemping to achieve rapid compliance, after notification of a violation, shall be considered by the President.

"(k) There is hereby authorized to be appropriated to a revolving fund to be established in the Treasury not to exceed $35,000,000 to carry out the provisions of subsections (c), (d), (i), and (l) of this section. Any other funds received by the United States under this section shall also be deposited in said fund for such purposes. All sums appropriated to, or deposited in, said fund shall remain available until expended.

"(l) The President is authorized to delegate the administration of this section to the heads of those Federal departments, agencies, and instrumentalities which he determines to be appropriate. Any moneys in the fund established by subsection (k) of this section shall be available to such Federal departments, agencies, and instrumentalities to carry out the provisions of subsections (c) and (i) of this section. Each such department, agency, and instrumentality, in order to avoid duplication of effort, shall, whenever appropriate, utilize the personnel, services, and facilities of other Federal departments, agencies, and instrumentalities.

"(m) Anyone authorized by the President to enforce the provisions of this section may, except as to public vessels, (A) board and inspect any vessel upon the navigable waters of the United States or the waters of the contiguous zone, (B) with or without a warrant arrest any person who violates the provisions of this section or any regulation issued thereunder in his presence or view, and (C) execute any warrant or other process issued by an officer or court of competent jurisdiction.

"(n) The several district courts of the United States are invested with jurisdiction for any actions, other than actions pursuant to subsection (i)(1), arising under this section. In the case of Guam and the Trust Territory of the Pacific Islands, such actions may be brought in the district court of Guam, and in the case of the Virgin Islands such actions may be brought in the district court of the Virgin Islands. In the case of American Samoa and the Trust Territory of the Pacific Islands, such actions may be brought in the District Court of the United States for the District of Hawaii and such court shall have jurisdiction of such actions. In the case of the Canal Zone, such actions may be brought in the United States District Court for the District of the Canal Zone.

"(o)(1) Nothing in this section shall affect or modify in any way the obligations of any owner or operator of any vessel, or of any owner or operator of any onshore facility or offshore facility to any person or agency under any provision of law for damages to any publicly owned or privately owned property resulting from a discharge of any oil or hazardous substance or from the removal of any such oil or hazardous substance.

"(2) Nothing in this section shall be construed as preempting any State or political subdivision thereof from imposing any requirement or liability with respect to the discharge of oil or hazardous substance into any waters within such State.

"(3) Nothing in this section shall be construed as affecting or modifying any other existing authority of any Federal department, agency, or instrumentality, relative to onshore or offshore facilities under this Act or any other provision of law, or to affect any State or local law not in conflict with this section.

"(p)(1) Any vessel over three hundred gross tons, including any barge of equivalent size, but not including any barge that is not self-propelled and that does not carry oil or hazardous substances as cargo or fuel, using any port or place in the United States or the navigable waters of the United States for any purpose shall establish and maintain under regulations to be prescribed from time to time by the President, evidence of financial responsibility of $100 per gross ton, or $14,000,000 whichever is the lesser, to meet the liability to the United States which such vessel could be subjected under this section. In cases where an owner or operator owns, operates, or charters more than one such vessel, financial responsibility need only be established to meet the maximum liability to which the largest of such vessels could be subjected. Financial responsibility may be established by any one of, or a combination of, the following methods acceptable to the Presi-

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dent: (A) evidence of insurance, (B) surety bonds, (C) qualification as a self-insurer, or (D) other evidence of financial responsibility. Any bond filed shall be issued by a bonding company authorized to do business in the United States.

"(2) The provisions of paragraph (1) of this subsection shall be effective April 3, 1971, with respect to oil and one year after the date of enactment of this section with respect to hazardous substances. The President shall delegate the responsibility to carry out the provisions of this subsection to the appropriate agency head within sixty days after the date of enactment of this section. Regulations necessary to implement this subsection shall be issued within six months after the date of enactment of this section.

"(3) Any claim for costs incurred by such vessel may be brought directly against the insurer or any other person providing evidence of financial responsibility as required under this subsection. In the case of any action pursuant to this subsection such insurer or other person shall be entitled to invoke all rights and defenses which would have been available to the owner or operator if an action had been brought against him by the claimant, and which would have been available to him if an action had been brought against him by the owner or operator.

"(4) Any owner or operator of a vessel subject to this subsection, who fails to comply with the provisions of this subsection or any regulation issued thereunder, shall be subject to a fine of not more than $10,000.

"(5) The Secretary of the Treasury may refuse the clearance required by section 4197 of the Revised Statutes of the United States, as amended (4 U.S.C. 91), to any vessel subject to this subsection, which does not have evidence furnished by the President that the financial responsibility provisions of paragraph (1) of this subsection have been complied with.

"(6) The Secretary of the Department in which the Coast Guard is operated may (A) deny entry to any port or place in the United States or the navigable waters of the United States, to, and (B) detain at the port or place in the United States from which it is about to depart for any other port or place in the United States, any vessel subject to this subsection, which upon request, does not produce evidence furnished by the President that the financial responsibility provisions of paragraph (1) of this subsection have been complied with.

"MARINE SANITATION DEVICES

"SEC. 312. (a) For the purpose of this section, the term—

"(1) 'new vessel' includes every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on the navigable waters, the construction of which is initiated after promulgation of standards and regulations under this section;

"(2) 'existing vessel' includes every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on the navigable waters, the construction of which is initiated before promulgation of standards and regulations under this section;

"(3) 'public vessel' means a vessel owned or bareboat chartered and operated by the United States, by a State or political subdivision thereof, or by a foreign nation, except when such vessel is engaged in commerce;

"(4) 'United States' includes the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Canal Zone, and the Trust Territory of the Pacific Islands;

"(5) 'marine sanitation device' includes any equipment for installation on board a vessel which is designed to receive, retain, treat, or discharge sewage, and any process to treat such sewage;

"(6) 'sewage' means human body wastes and the wastes from toilets and other receptacles intended to receive or retain body wastes;

"(7) 'manufacturer' means any person engaged in the manufacturing, assembling, or importation of marine sanitation devices or of vessels subject to standards and regulations promulgated under this section;

"(8) 'person' means an individual, partnership, firm, corporation, or association, but does not include an individual on board a public vessel;

"(9) 'discharge' includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying or dumping.

"(b)(1) As soon as possible, after the enactment of this section and subject to the provisions of section 104(j) of this Act, the Administrator, after consultation with the Secretary of the department in which the Coast Guard is operating, after giving appropriate consideration to the economic costs involved, and within the limits of available technology, shall promulgate Federal standards of performance for marine sanitation devices (hereafter in this section referred to as 'standards') which shall be designed to prevent the discharge of untreated or inadequately treated sewage into or upon the navigable waters from new vessels and existing vessels, except vessels not equipped with installed toilet facilities. Such standards shall be consistent with maritime safety and the marine and navigation laws and regulations and shall be coordinated with the regulations issued under this subsection by the Secretary of the department in which the Coast Guard is operating. The Secretary of the department in which the Coast Guard is operating shall promulgate regulations, which are consistent with standards promulgated under this subsection and with maritime safety and the marine and navigation laws and regulations governing the design, construction, installation, and operation of any marine sanitation device on board such vessels.

"(2) Any existing vessel equipped with a marine sanitation device on the date of promulgation of initial standards and regulations under this section, which device is in compliance with such initial standards and regulations, shall be deemed in compliance with this section until such time as the device is replaced or is found not to be in compliance with such initial standards and regulations.

"(c)(1) Initial standards and regulations under this section shall become effective for new vessels two years after promulgation; and for existing vessels five years after promulgation. Revisions of standards and regulations shall be effective upon promulgation, unless another effective date is specified, except that no revision shall take effect before the effective date of the standard or regulation being revised.

"(2) The Secretary of the department in which the Coast Guard is operating with regard to his regulatory authority established by this section, after consultation with the Administrator, may distinguish among classes, type, and sizes of vessels as well as between new and existing vessels, and may waive applicability of standards and regulations as necessary or appropriate for such classes, types, and sizes of vessels (including existing vessels equipped with marine sanitation devices on the date of promulgation of the initial standards required by this section), and, upon application, for individual vessels.

"(d) The provisions of this section and the standards and regulations promulgated hereunder apply to vessels owned and operated by the United States unless the Secretary of Defense finds that compliance would not be in the interest of national security. With respect to vessels owned and operated by the Department of Defense, regulations under the last sentence of subsection (b)(1) of this section and certifications under subsection (g)(2) of this section shall be promulgated and issued by the Secretary of Defense.

"(e) Before the standards and regulations under this section are promulgated, the Administrator and the Secretary of the department in which the Coast Guard is operating shall consult with the Secretary of State; the Secretary of Health, Education, and Welfare; the Secretary of Defense; the Secretary of the Treasury; the Secretary of Commerce; other interested Federal agencies; and the States and industries interested; and otherwise comply with the requirements of section 553 of title 5 of the United States Code.

"(f)(1) After the effective date of the initial standards and regulations promulgated under this section, no State or political subdivision thereof shall adopt or enforce any statute or regulation of such State or political subdivision with respect to the design, manufacture, or installation or use of any marine sanitation device on any vessel subject to the provisions of this section.

"(2) If, after promulgation of the initial standards and regulations and prior to their effective date, a vessel is equipped with a marine sanitation device in compliance with such standards and regulations and the installation and operation of such device is in accordance with such standards and regulations, such standards and regulations shall, for the purposes of paragraph (1) of this subsection, become effective with repect to such vessel on the date of such compliance.

"(3) After the effective date of the initial standards and regulations promulgated under this section, if any State determines that the protection and enhancement of the quality of some or all of the waters within such State require greater environmental protection, such State may completely prohibit the discharge from all vessels of any sewage, whether treated or not, into such waters, except that no such prohibition shall apply until the Administrator determines that adequate facilities for the safe and sanitary removal and treatment of sewage from all vessels are reasonably available for such water to which such prohibition would apply. Upon application of the State, the Administrator shall make such determination within 90 days of the date of such application.

"(4) If the Administrator determines upon application by a State that the protection and enhancement of the quality of specified waters within such State requires such a prohibition, he shall by regulation completely prohibit the discharge from a vessel of any sewage (whether treated or not) into such waters.

"(g)(1) No manufacturer of a marine sanitation device shall sell, offer for sale, or introduce or deliver for introduction in interstate commerce, or import into the United States for sale or resale any marine sanitation device manufactured after the effective date of the standards and regulations promulgated under this section unless such device is in all material respects substantially the same as a test device certified under this subsection.

"(2) Upon application of the manufacturer, the Secretary of the

department in which the Coast Guard is operating shall so certify a marine sanitation device if he determines, in accordance with the provisions of this paragraph, that it meets the appropriate standards and regulations promulgated under this section. The Secretary of the department in which the Coast Guard is operating shall test or require such testing of the device in accordance with procedures set forth by the Administrator as to standards of performance and for such other purposes as may be appropriate. If the Secretary of the department in which the Coast Guard is operating determines that the device is satisfactory from the standpoint of safety and any other requirements of maritime law or regulation, and after consideration of the design, installation, operation, material, or other appropriate factors, he shall certify the device. Any device manufactured by such manufacturer which is in all material respects substantially the same as the certified test device shall be deemed to be in conformity with the appropriate standards and regulations established under this section.

"(3) Every manufacturer shall establish and maintain such records, make such reports, and provide such information as the Administrator or the Secretary of the department in which the Coast Guard is operating may reasonably require to enable him to determine whether such manufacturer has acted or is acting in compliance with this section and regulations issued thereunder and shall, upon request of an officer or employee duly designated by the Administrator or the Secretary of the department in which the Coast Guard is operating, permit such officer or employee at reasonable times to have access to and copy such records. All information reported to or otherwise obtained by the Administrator or the Secretary of the department in which the Coast Guard is operating or their representatives pursuant to this subsection which contains or relates to a trade secret or other matter referred to in section 1905 of title 18 of the United States Code shall be considered confidential for the purpose of that section, except that such information may be disclosed to other officers or employees concerned with carrying out this section. This paragraph shall not apply in the case of the construction of a vessel by an individual for his own use.

"(h) After the effective date of standards and regulations promulgated under this section, it shall be unlawful—

"(1) for the manufacturer of any vessel subject to such standards and regulations to manufacture for sale, to sell or offer for sale, or to distribute for sale or resale any such vessel unless it is equipped with a marine sanitation device which is in all material respects substantially the same as the appropriate test device certified pursuant to this section;

"(2) for any person, prior to the sale or delivery of a vessel subject to such standards and regulations to the ultimate purchaser, wrongfully to remove or render inoperative any certified marine sanitation device or element of design of such device installed in such vessel;

"(3) for any person to fail or refuse to permit access to or copying of records or to fail to make reports or provide information required under this section; and

"(4) for a vessel subject to such standards and regulations to operate on the navigable waters of the United States, if such vessel is not equipped with an operable marine sanitation device certified pursuant to this section.

"(i) The district courts of the United States shall have jurisdictions to restrain violations of subsection (g)(1) of this section and subsections (h)(1) through (3) of this section. Actions to restrain such violations shall be brought by, and in, the name of the United States. In case of contumacy or refusal to obey a subpena served upon any person under this subsection, the district court of the United States for any district in which such person is found or resides or transacts business, upon application by the United States and after notice to such person, shall have jurisdiction to issue an order requiring such person to appear and give testimony or to appear and produce documents, and any failure to obey such order of the court may be punished by such court as a contempt thereof.

"(j) Any person who violates subsection (g)(1) of this section or clause (1) or (2) of subsection (h) of this section shall be liable to a civil penalty of not more than $5,000 for each violation. Any person who violates clause (4) of subsection (h) of this section or any regulation issued pursuant to this section shall be liable to a civil penalty of not more than $2,000 for each violation. Each violation shall be a separate offense. The Secretary of the department in which the Coast Guard is operating may assess and compromise any such penalty. No penalty shall be assessed until the person charged shall have been given notice and an opportunity for a hearing on such charge. In determining the amount of the penalty, or the amount agreed upon in compromise, the gravity of the violation, and the demonstrated good faith of the person charged in attempting to achieve rapid compliance, after notification of a violation, shall be considered by said Secretary.

"(k) The provisions of this section shall be enforced by the Secretary of the department in which the Coast Guard is operating and he may utilize by agreement, with or without reimbursement, law enforcement officers or other personnel and facilities of the Administrator, other Federal agencies, or the States to carry out the provisions of this section.

"(l) Anyone authorized by the Secretary of the department in which the Coast Guard is operating to enforce the provisions of this section may, except as to public vessels, (1) board and inspect any vessel upon the navigable waters of the United States and (2) execute any warrant or other process issued by an officer or court of competent jurisdiction.

"(m) In the case of Guam and the Trust Territory of the Pacific Islands, actions arising under this section may be brought in the district court of Guam, and in the case of the Virgin Islands such actions may be brought in the district court of the Virgin Islands. In the case of American Samoa and the Trust Territory of the Pacific Islands, such actions may be brought in the District Court of the United States for the District of Hawaii and such court shall have jurisdiction of such actions. In the case of the Canal Zone, such actions may be brought in the District Court for the District of the Canal Zone.

"FEDERAL FACILITIES POLLUTION CONTROL

"SEC. 313. Each department, agency, or instrumentality of the executive, legislative, and judicial branches of the Federal Government (1) having jurisdiction over any property or facility, or (2) engaged in any activity resulting, or which may result, in the discharge or runoff of pollutants shall comply with Federal, State, interstate, and local requirements respecting control and abatement of pollution to the same extent that any person is subject to such requirements, including the payment of reasonable service charges. The President may exempt any effluent source of any department, agency, or instrumentality in the executive branch from compliance with any such a requirement if he determines it to be in the paramount interest of the United States to do so; except that no exemption may be granted from the requirements of section 306 or 307 of this Act. No such exemptions shall be granted due to lack of appropriation unless the President shall have specifically requested such appropriation as a part of the budgetary process and the Congress shall have failed to make available such requested appropriation. Any exemption shall be for a period not in excess of one year, but additional exemptions may be granted for periods of not to exceed one year upon the President's making a new determination. The President shall report each January to the Congress all exemptions from the requirements of this section granted during the preceding calendar year, together with his reason for granting such exemption.

"CLEAN LAKES

"SEC. 314. (a) Each State shall prepare or establish, and submit to the Administrator for his approval—

"(1) an identification and classification according to eutrophic condition of all publicly owned fresh water lakes in such State;

"(2) procedures, processes, and methods (including land use requirements), to control sources of pollution of such lakes; and

"(3) methods and procedures, in conjunction with appropriate Federal agencies, to restore the quality of such lakes.

"(b) The Administrator shall provide financial assistance to States in order to carry out methods and procedures approved by him under this section.

"(c)(1) The amount granted to any State for any fiscal year under this section shall not exceed 70 per centum of the funds expended by such State in such year for carrying out approved methods and procedures under this section.

"(2) There is authorized to be appropriated $50,000,000 for the fiscal year ending June 30, 1973; $100,000,000 for the fiscal year 1974; and $150,000,000 for the fiscal year 1975 for grants to States under this section which such sums shall remain available until expended. The Administrator shall provide for an equitable distribution of such sums to the States with approved methods and procedures under this section.

"NATIONAL STUDY COMMISSION

"SEC. 315. (a) There is established a National Study Commission, which shall make a full and complete investigation and study of all of the technological aspects of achieving, and all aspects of the total economic, social, and environmental effects of achieving or not achieving, the effluent limitations and goals set forth for 1983 in section 301(b)(2) of this Act.

"(b) Such Commission shall be composed of fifteen members, including five members of the Senate, who are members of the Public Works committee, appointed by the President of the Senate, five members of the House, who are members of the Public Works committee, appointed by the Speaker of the House, and five members of the public appointed by the President. The Chairman of such Commission shall be elected from among its members.

"(c) In the conduct of such study, the Commission is authorized to contract with the National Academy of Sciences and the National Academy of Engineering (acting through the National Research Council), the National Institute of Ecology, Brookings Institution, and other nongovernmental entities, for the investigation of matters within their competence.

"(d) The heads of the departments, agencies and instrumentalities of the executive branch of the Federal Government shall cooperate

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with the Commission in carrying out the requirements of this section, and shall furnish to the Commission such information as the Commission deems necessary to carry out this section.

"(e) A report shall be submitted to the Congress of the results of such investigation and study, together with recommendations, not later than three years after the date of enactment of this title.

"(f) The members of the Commission who are not officers or employees of the United States, while attending conferences or meetings of the Commission or while otherwise serving at the request of the Chairman shall be entitled to receive compensation at a rate not in excess of the maximum rate of pay for grade GS-18, as provided in the General Schedule under section 5332 of title V of the United States Code, including traveltime and while away from their homes or regular places of business they may be allowed travel expenses, including per diem in lieu of subsistence as authorized by law (5 U.S.C. 73b-2) for persons in the Government service employed intermittently.

"(g) In addition to authority to appoint personnel subject to the provisions of title 5, United States Code, governing appointments in the competitive service, and to pay such personnel in accordance with the provisions of chapter 51 and subchapter III of chapter 53 of such title relating to classification and General Schedule pay rates, the Commission shall have authority to enter into contracts with private or public organization who shall furnish the Commission with such administrative and technical personnel as may be necessary to carry out the purpose of this section. Personnel furnished by such organizations under this subsection are not, and shall not be considered to be, Federal employees for any purposes, but in the performance of their duties shall be guided by the standards which apply to employees of the legislative branches under rules 41 and 43 of the Senate and House of Representatives, respectively."; and

(h) There is authorized to be appropriated, for use in carrying out this section, not to exceed $17,250,000.

"THERMAL DISCHARGES

"SEC. 316. (a) With respect to any point source otherwise subject to the provisions of section 301 or section 306 of this Act, whenever the owner or operator of any such source, after opportunity for public hearing, can demonstrate to the satisfaction of the Administrator (or, if appropriate, the State) that any effluent limitation proposed for the control of the thermal component of any discharge from such source will require effluent limitations more stringent than necessary to assure the projection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made, the Administrator (or, if appropriate, the State) may impose an effluent limitation under such sections for such plant, with respect to the thermal component of such discharge (taking into account the interaction of such thermal component with other pollutants), that will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water.

"(b) Any standard established pursuant to section 301 or section 306 of this Act and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

"(c) Notwithstanding any other provision of this Act, any point source of a discharge having a thermal component, the modification of which point source is commenced after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972 and which, as modified, meets effluent limitations established under section 301 or, if more stringent, effluent limitations established under section 303 and which effluent limitations will assure protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in or on the water into which the discharge is made, shall not be subject to any more stringent effluent limitation with respect to the thermal component of its discharge during a ten year period beginning on the date of completion of such modification or during the period of depreciation or amortization of such facility for the purpose of section 167 or 169 (or both) of the Internal Revenue Code of 1954, whichever period ends first.

"FINANCING STUDY

"SEC. 317. (a) The Administrator shall continue to investigate and study the feasibility of alternate methods of financing the cost of preventing, controlling and abating pollution as directed in the Water Quality Improvement Act of 1970 (Public Law 91-224), including, but not limited to, the feasibility of establishing a pollution abatement trust fund. The results of such investigation and study shall be reported to the Congress not later than two years after enactment of this title, together with recommendations of the Administrator for financing the programs for preventing, controlling and abating pollution for the fiscal years beginning after fiscal year 1976, including any necessary legislation.

"(b) There is authorized to be appropriated for use in carrying out this section, not to exceed $1,000,000.

"AQUACULTURE

"SEC. 318. (a) The Administrator is authorized, after public hearings, to permit the discharge of a specific pollutant or pollutants under controlled conditions associated with an approved aquaculture project under Federal or State supervision.

"(b) The Administrator shall by regulation, not later than January 1, 1974, establish any procedures and guidelines he deems necessary to carry out this section.

"TITLE IV—PERMITS AND LICENSES

"CERTIFICATION

"SEC. 401. (a)(1) Any applicant for a Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters, shall provide the licensing or permitting agency a certification from the State in which the discharge originates or will originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over the navigable waters at the point where the discharge originates or will originate, that any such discharge will comply with the applicable provisions of sections 301, 302, 306, and 307 of this Act. In the case of any such activity for which there is not an applicable effluent limitation or other limitation under sections 301(b) and 302, and there is not an applicable standard under sections 306 and 307, the State shall so certify, except that any such certification shall not be deemed to satisfy section 511(c) of this Act. Such State or interstate agency shall establish procedures for public notice in the case of all applications for certification by it and, to the extent it deems appropriate, procedures for public hearings in connection with specific applications. In any case where a State or interstate agency has no authority to give such a certification, such certification shall be from the Administrator. If the State, interstate agency, or Administrator, as the case may be, fails or refuses to act on a request for certification, within a reasonable period of time (which shall not exceed one year) after receipt of such request, the certification requirements of this subsection shall be waived with respect to such Federal application. No license or permit shall be granted until the certification required by this section has been obtained or has been waived as provided in the preceding sentence. No license or permit shall be granted if certification has been denied by the State, interstate agency, or the Administrator, as the case may be.

"(2) Upon receipt of such application and certification the licensing or permitting agency shall immediately notify the Administrator of such application and certification. Whenever such a discharge may affect, as determined by the Administrator, the quality of the waters of any other State, the Administrator within thirty days of the date of notice of application for such Federal license or permit shall so notify such other State, the licensing or permitting agency, and the applicant. If, within sixty days after receipt of such notification, such other State determines that such discharge will affect the quality of its waters so as to violate any water quality requirement in such State, and within such sixty-day period notifies the Administrator and the licensing or permitting agency in writing of its objection to the issuance of such license or permit and requests a public hearing on such objection, the licensing or permitting agency shall hold such a hearing. The Administrator shall at such hearing submit his evaluation and recommendations with respect to any such objection to the licensing or permitting agency. Such agency, based upon the recommendations of such State, the Administrator, and upon any additional evidence, if any, presented to the agency at the hearing, shall condition such license or permit in such manner as may be necessary to insure compliance with applicable water quality requirements. If the imposition of conditions cannot insure such compliance such agency shall not issue such license or permit.

"(3) The certification obtained pursuant to paragraph (1) of this subsection with respect to the construction of any facility shall fulfill the requirements of this subsection with respect to certification in connection with any other Federal license or permit required for the operation of such facility unless, after notice to the certifying State, agency, or Administrator, as the case may be, which shall be given by the Federal agency to whom application is made for such operating license or permit, the State, or if appropriate, the interstate agency or the Administrator, notifies such agency within sixty days after receipt of such notice that there is no longer reasonable assurance that there will be compliance with the applicable provisions of sections 301, 302, 306, and 307 of this Act because of changes since the construction license or permit certification was issued in (A) the construction or operation of the facility, (B) the characteristics of the waters into which such discharge is made, (C) the water quality criteria applicable to such waters or (D) applicable effluent limitations or other requirements. This paragraph shall be inapplicable in any case where the applicant for such operating license or permit has failed to provide the certifying State, or, if appropriate, the interstate agency or the Administrator, with notice of any proposed

changes in the construction or operation of the facility with respect to which a construction license or permit has been granted, which changes may result in violation of section 301, 302, 306, or 307 of this Act.

"(4) Prior to the initial operation of any federally licensed or permitted facility or activity which may result in any discharge into the navigable waters and with respect to which a certification has been obtained pursuant to paragraph (1) of this subsection, which facility or activity is not subject to a Federal operating license or permit, the licensee or permittee shall provide an opportunity for such certifying State, or, if appropriate, the interstate agency or the Administrator to review the manner in which the facility or activity shall be operated or conducted for the purposes of assuring that applicable effluent limitations or other limitations or other applicable water quality requirements will not be violated. Upon notification by the certifying State, or if appropriate, the interstate agency or the Administrator that the operation of any such federally licensed or permitted facility or activity will violate applicable effluent limitations or other limitations or other water quality requirements such Federal agency may, after public hearing, suspend such license or permit. If such license or permit is suspended, it shall remain suspended until notification is received from the certifying State, agency, or Administrator, as the case may be, that there is reasonable assurance that such facility or activity will not violate the applicable provisions of section 301, 302, 306, or 307 of this Act.

"(5) Any Federal license or permit with respect to which a certification has been obtained under paragraph (1) of this subsection may be suspended or revoked by the Federal agency issuing such license or permit upon the entering of a judgment under this Act that such facility or activity has been operated in violation of the applicable provisions of section 301, 302, 306, or 307 of this Act.

"(6) No Federal agency shall be deemed to be an applicant for the purposes of this subsection.

"(7) Except with respect to a permit issued under section 402 of this Act, in any case where actual construction of a facility has been lawfully commenced prior to April 3, 1970, no certification shall be required under this subsection for a license or permit issued after April 3, 1970, to operate such facility, except that any such license or permit issued without certification shall terminate April 3, 1973, unless prior to such termination date the person having such license or permit submits to the Federal agency which issued such license or permit a certification and otherwise meets the requirements of this section.

"(b) Nothing in this section shall be construed to limit the authority of any department or agency pursuant to any other provision of law to require compliance with any applicable water quality requirements. The Administrator shall, upon the request of any Federal department or agency, or State or interstate agency, or applicant, provide, for the purpose of this section, any relevant information on applicable effluent limitations, or other limitations, standards, regulations, or requirements, or water quality criteria, and shall, when requested by any such department or agency or State or interstate agency, or applicant, comment on any methods to comply with such limitations, standards, regulations, requirements, or criteria.

"(c) In order to implement the provisions of this section, the Secretary of the Army, acting through the Chief of Engineers, is authorized, if he deems it to be in the public interest, to permit the use of spoil disposal areas under his jurisdiction by Federal licensees or permittees, and to make an appropriate charge for such use. Moneys received from such licensees or permittees shall be deposited in the Treasury as miscellaneous receipts.

"(d) Any certification provided under this section shall set forth any effluent limitations and other limitations, and monitoring requirements necessary to assure that any applicant for a Federal license or permit will comply with any applicable effluent limitations and other limitations, under section 301 or 302 of this Act, standard of performance under section 306 of this Act, or prohibition, effluent standard, or pretreatment standard under section 307 of this Act, and with any other appropriate requirement of State law set forth in such certification, and shall become a condition on any Federal license or permit subject to the provisions of this section.

"NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

"SEC. 402. (a) (1) Except as provided in sections 318 and 404 of this Act, the Administrator may, after opportunity for public hearing, issue a permit for the discharge of any pollutant, or combination of pollutants, notwithstanding section 301(a), upon condition that such discharge will meet either all applicable requirements under sections 301, 302, 306, 307, 308, and 403 of this Act, or prior to the taking of necessary implementing actions relating to all such requirements, such conditions as the Administrator determines are necessary to carry out the provisions of this Act.

"(2) The Administrator shall prescribe conditions for such permits to assure compliance with the requirements of paragraph (1) of this subsection, including conditions on data and information collection, reporting, and such other requirements as he deems appropriate.

"(3) The permit program of the Administrator under paragraph (1) of this subsection, and permits issued thereunder, shall be subject to the same terms, conditions, and requirements as apply to a State permit program and permits issued thereunder under subsection (b) of this section.

"(4) All permits for discharges into the navigable waters issued pursuant to section 13 of the Act of March 3, 1899, shall be deemed to be permits issued under this title, and permits issued under this title shall be deemed to be permits issued under section 13 of the Act of March 3, 1899, and shall continue in force and effect for their term unless revoked, modified, or suspended in accordance with the provisions of this Act.

"(5) No permit for a discharge into the navigable waters shall be issued under section 13 of the Act of March 3, 1899, after the date of enactment of this title. Each application for a permit under section 13 of the Act of March 3, 1899, pending on the date of enactment of this Act shall be deemed to be an application for a permit under this section. The Administrator shall authorize a State, which he determines has the capability of administering a permit program which will carry out the objective of this Act, to issue permits for discharges into the navigable waters within the jurisdiction of such State. The Administrator may exercise the authority granted him by the preceding sentence only during the period which begins on the date of enactment of this Act and ends either on the ninetieth day after the date of the first promulgation of guidelines required by section 304 (h) (2) of this Act, or the date of approval by the Administrator of a permit program for such State under subsection (b) of this section, whichever date first occurs, and no such authorization to a State shall extend beyond the last day of such period. Each such permit shall be subject to such conditions as the Administrator determines are necessary to carry out the provisions of this Act. No such permit shall issue if the Administrator objects to such issuance.

"(b) At any time after the promulgation of the guidelines required by subsection (h) (2) of section 304 of this Act, the Governor of each State desiring to administer its own permit program for discharges into navigable waters within its jurisdiction may submit to the Administrator a full and complete description of the program it proposes to establish and administer under State law or under an interstate compact. In addition, such State shall submit a statement from the attorney general (or the attorney for those State water pollution control agencies which have independent legal counsel), or from the chief legal officer in the case of an interstate agency, that the laws of such State, or the interstate compact, as the case may be, provide adequate authority to carry out the described program. The Administrator shall approve each such submitted program unless he determines that adequate authority does not exist:

"(1) To issue permits which—

"(A) apply, and insure compliance with, any applicable requirements of sections 301, 302, 306, 307, and 403;

"(B) are for fixed terms not exceeding five years; and

"(C) can be terminated or modified for cause including, but not limited to, the following:

"(i) violation of any condition of the permit;

"(ii) obtaining a permit by misrepresentation, or failure to disclose fully all relevant facts;

"(iii) change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge;

"(D) control the disposal of pollutants into wells;

"(2) (A) To issue permits which apply, and insure compliance with, all applicable requirements of section 308 of this Act, or

"(B) To inspect, monitor, enter, and require reports to at least the same extent as required in section 308 of this Act;

"(3) To insure that the public, and any other State the waters of which may be affected, receive notice of each application for a permit and to provide an opportunity for public hearing before a ruling on each such application;

"(4) To insure that the Administrator receives notice of each application (including a copy thereof) for a permit;

"(5) To insure that any State (other than the permitting State), whose waters may be affected by the issuance of a permit may submit written recommendations to the permitting State (and the Administrator) with respect to any permit application and, if any part of such written recommendations are not accepted by the permitting State, that the permitting State will notify such affected State (and the Administrator) in writing of its failure to so accept such recommendations together with its reasons for so doing;

"(6) To insure that no permit will be issued if, in the judgment of the Secretary of the Army acting through the Chief of Engineers, after consultation with the Secretary of the department in which the Coast Guard is operating, anchorage and navigation of any of the navigable waters would be substantially impaired thereby;

"(7) To abate violations of the permit or the permit program, including civil and criminal penalties and other ways and means of enforcement;

"(8) To insure that any permit for a discharge from a publicly

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owned treatment works includes conditions to require adequate notice to the permitting agency of (A) new introductions into such works of pollutants from any source which would be a new source as defined in section 306 if such source were discharging pollutants, (B) new introductions of pollutants into such works from a source which would be subject to section 301 if it were discharging such pollutants, or (C) a substantial change in volume or character of pollutants being introduced into such works by a source introducing pollutants into such works at the time of issuance of the permit. Such notice shall include information on the quality and quantity of effluent to be introduced into such treatment works and any anticipated impact of such change in the quantity or quality of effluent to be discharged from such publicly owned treatment works; and

"(9) To insure that any industrial user of any publicly owned treatment works will comply with sections 204(b), 307, and 308.

"(c)(1) Not later than ninety days after the date on which a State has submitted a program (or revision thereof) pursuant to subsection (b) of this section, the Administrator shall suspend the issuance of permits under subsection (a) of this section as to those navigable waters subject to such program unless he determines that the State permit program does not meet the requirements of subsection (b) of this section or does not conform to the guidelines issued under section 304(h)(2) of this Act. If the Administrator so determines, he shall notify the State of any revisions or modifications necessary to conform to such requirements or guidelines.

"(2) Any State permit program under this section shall at all times be in accordance with this section and guidelines promulgated pursuant to section 304(h)(2) of this Act.

"(3) Whenever the Administrator determines after public hearing that a State is not administering a program approved under this section in accordance with requirements of this section, he shall so notify the State and, if appropriate corrective action is not taken within a reasonable time, not to exceed ninety days, the Administrator shall withdraw approval of such program. The Administrator shall not withdraw approval of any such program unless he shall first have notified the State, and made public, in writing, the reasons for such withdrawal.

"(d)(1) Each State shall transmit to the Administrator a copy of each permit application received by such State and provide notice to the Administrator of every action related to the consideration of such permit application, including each permit proposed to be issued by such State.

"(2) No permit shall issue (A) if the Administrator within ninety days of the date of his notification under subsection (b)(5) of this section objects in writing to the issuance of such permit, or (B) if the Administrator within ninety days of the date of transmittal of the proposed permit by the State objects in writing to the issuance of such permit as being outside the guidelines and requirements of this Act.

"(3) The Administrator may, as to any permit application, waive paragraph (2) of this subsection.

"(e) In accordance with guidelines promulgated pursuant to subsection (h)(2) of section 304 of this Act, the Administrator is authorized to waive the requirements of subsection (d) of this section at the time he approves a program pursuant to subsection (b) of this section for any category (including any class, type, or size within such category) of point sources within the State submitting such program.

"(f) The Administrator shall promulgate regulations establishing categories of point sources which he determines shall not be subject to the requirements of subsection (d) of this section in any State with a program approved pursuant to subsection (b) of this section. The Administrator may distinguish among classes, types, and sizes within any category of point sources.

"(g) Any permit issued under this section for the discharge of pollutants into the navigable waters from a vessel or other floating craft shall be subject to any applicable regulations promulgated by the Secretary of the department in which the Coast Guard is operating, establishing specifications for safe transportation, handling, carriage, storage, and stowage of pollutants.

"(h) In the event any condition of a permit for discharges from a treatment works (as defined in section 212 of this Act) which is publicly owned is violated, a State with a program approved under subsection (b) of this section or the Administrator, where no State program is approved, may proceed in a court of competent jurisdiction to restrict or prohibit the introduction of any pollutant into such treatment works by a source not utilizing such treatment works prior to the finding that such condition was violated.

"(i) Nothing in this section shall be construed to limit the authority of the Administrator to take action pursuant to section 309 of this Act.

"(j) A copy of each permit application and each permit issued under this section shall be available to the public. Such permit application or permit, or portion thereof, shall further be available on request for the purpose of reproduction.

"(k) Compliance with a permit issued pursuant to this section shall be deemed compliance, for purposes of sections 309 and 505, with sections 301, 302, 306, 307, and 403, except any standard imposed under section 307 for a toxic pollutant injurious to human health. Until December 31, 1974, in any case where a permit for discharge has been applied for pursuant to this section, but final administrative disposition of such application has not been made, such discharge shall not be a violation of (1) section 301, 306, or 402 of this Act, or (2) section 13 of the Act of March 3, 1899, unless the Administrator or other plaintiff proves that final administrative disposition of such application has not been made because of the failure of the applicant to furnish information reasonably required or requested in order to process the application. For the 180-day period beginning on the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, in the case of any point source discharging any pollutant or combination of pollutants immediately prior to such date of enactment which source is not subject to section 13 of the Act of March 3, 1899, the discharge by such source shall not be a violation of this Act if such a source applies for a permit for discharge pursuant to this section within such 180-day period.

"OCEAN DISCHARGE CRITERIA

"SEC. 403. (a) No permit under section 402 of this Act for a discharge into the territorial sea, the waters of the contiguous zone, or the oceans shall be issued, after promulgation of guidelines established under subsection (c) of this section, except in compliance with such guidelines. Prior to the promulgation of such guidelines, a permit may be issued under such section 402 if the Administrator determines it to be in the public interest.

"(b) The requirements of subsection (d) of section 402 of this Act may not be waived in the case of permits for discharges into the territorial sea.

"(c)(1) The Administrator shall, within one hundred and eighty days after enactment of this Act (and from time to time thereafter), promulgate guidelines for determining the degradation of the waters of the territorial seas, the contiguous zone, and the oceans, which shall include:

"(A) the effect of disposal of pollutants on human health or welfare, including but not limited to plankton, fish, shellfish, wildlife, shorelines, and beaches;

"(B) the effect of disposal of pollutants on marine life including the transfer, concentration, and dispersal of pollutants or their byproducts through biological, physical, and chemical processes; changes in marine ecosystem diversity, productivity, and stability; and species and community population changes;

"(C) the effect of disposal, of pollutants on esthetic, recreation, and economic values;

"(D) the persistence and permanence of the effects of disposal of pollutants;

"(E) the effect of the disposal at varying rates, of particular volumes and concentrations of pollutants;

"(F) other possible locations and methods of disposal or recycling of pollutants including land-based alternatives; and

"(G) the effect on alternate uses of the oceans, such as mineral exploitation and scientific study.

"(2) In any event where insufficient information exists on any proposed discharge to make a reasonable judgment on any of the guidelines established pursuant to this subsection no permit shall be issued under section 402 of this Act.

"PERMITS FOR DREDGED OR FILL MATERIAL

"SEC. 404. (a) The Secretary of the Army, acting through the Chief of Engineers, may issue permits, after notice and opportunity for public hearings for the discharge of dredged or fill material into the navigable waters at specified disposal sites.

"(b) Subject to subsection (c) of this section, each such disposal site shall be specified for each such permit by the Secretary of the Army (1) through the application of guidelines developed by the Administrator, in conjunction with the Secretary of the Army, which guidelines shall be based upon criteria comparable to the criteria applicable to the territorial seas, the contiguous zone, and the ocean under section 403(c), and (2) in any case where such guidelines under clause (1) alone would prohibit the specification of a site, through the application additionally of the economic impact of the site on navigation and anchorage.

"(c) The Administrator is authorized to prohibit the specification (including the withdrawal of specification) of any defined area as a disposal site, and he is authorized to deny or restrict the use of any defined area for specification (including the withdrawal of specification) as a disposal site, whenever he determines, after notice and opportunity for public hearings, that the discharge of such materials into such area will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas. Before making such determination, the Administrator shall consult with the Secretary of the Army. The Administrator shall set forth in writing and make public his findings and his reasons for making any determination under this subsection.

"DISPOSAL OF SEWAGE SLUDGE

"SEC. 405. (a) Notwithstanding any other provision of this Act or of any other law, in any case where the disposal of sewage sludge resulting from the operation of a treatment works as defined in section 212 of this Act (including the removal of in-place sewage sludge from one location and its deposit at another location) would result in any pollutant from such sewage sludge entering the navigable waters, such disposal is prohibited except in accordance with a permit issued by the Administrator under this section.

"(b) The Administrator shall issue regulations governing the issuance of permits for the disposal of sewage sludge subject to this section. Such regulations shall require the application to such disposal of each criterion, factor, procedure, and requirement applicable to a permit issued under section 402 of this title, as the Administrator determines necessary to carry out the objective of this Act.

"(c) Each State desiring to administer its own permit program for disposal of sewage sludge within its jurisdiction may do so if upon submission of such program the Administrator determines such program is adequate to carry out the objective of this Act.

"TITLE V—GENERAL PROVISIONS

"ADMINISTRATION

"SEC. 501. (a) The Administrator is authorized to prescribe such regulations as are necessary to carry out his functions under this Act.

"(b) The Administrator, with the consent of the head of any other agency of the United States, may utilize such officers and employees of such agency as may be found necessary to assist in carrying out the purposes of this Act.

"(c) Each recipient of financial assistance under this Act shall keep such records as the Administrator shall prescribe, including records which fully disclose the amount and disposition by such recipient of the proceeds of such assistance, the total cost of the project or undertaking in connection with which such assistance is given or used, and the amount of that portion of the cost of the project or undertaking supplied by other sources, and such other records as will facilitate an effective audit.

"(d) The Administrator and the Comptroller General of the United States, or any of their duly authorized representatives, shall have access, for the purpose of audit and examination, to any books, documents, papers, and records of the recipients that are pertinent to the grants received under this Act.

"(e) (1) It is the purpose of this subsection to authorize a program which will provide official recognition by the United States Government to those industrial organizations and political subdivisions of States which during the preceding year demonstrated an outstanding technological achievement or an innovative process, method, or device in their waste treatment and pollution abatement programs. The Administrator shall, in consultation with the appropriate State water pollution control agencies, establish regulations under which such recognition may be applied for and granted, except that no applicant shall be eligible for an award under this subsection if such applicant is not in total compliance with all applicable water quality requirements under this Act, or otherwise does not have a satisfactory record with respect to environmental quality.

"(2) The Administrator shall award a certificate or plaque of suitable design to each industrial organization or political subdivision which qualifies for such recognition under regulations established under this subsection.

"(3) The President of the United States, the Governor of the appropriate State, the Speaker of the House of Representatives, and the President pro tempore of the Senate shall be notified of the award by the Administrator and the awarding of such recognition shall be published in the Federal Register.

"(f) Upon the request of a State water pollution control agency, personnel of the Environmental Protection Agency may be detailed to such agency for the purpose of carrying out the provisions of this Act.

"GENERAL DEFINITIONS

"SEC. 502. Except as otherwise specifically provided, when used in this Act:

"(1) The term 'State water pollution control agency' means the State agency designated by the Governor having responsibility for enforcing State laws relating to the abatement of pollution.

"(2) The term 'interstate agency' means an agency of two or more States established by or pursuant to an agreement or compact approved by the Congress, or any other agency of two or more States, having substantial powers or duties pertaining to the control of pollution as determined and approved by the Administrator.

"(3) The term 'State' means a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Trust Territory of the Pacific Islands.

"(4) The term 'municipality' means a city, town, borough, county, parish, district, association, or other public body created by or pursuant to State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of this Act.

"(5) The term 'person' means an individual, corporation, partnership, association, State, municipality, commission, or political subdivision of a State, or any interstate body.

"(6) The term 'pollutant' means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. This term does not mean (A) 'sewage from vessels' within the meaning of section 312 of this Act; or (B) water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil or gas production and disposed of in a well, if the well used either to facilitate production or for disposal purposes is approved by authority of the State in which the well is located, and if such State determines that such injection or disposal will not result in the degradation of ground or surface water resources.

"(7) The term 'navigable waters' means the waters of the United States, including the territorial seas.

"(8) The term 'territorial seas' means the belt of the seas measured from the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters, and extending seaward a distance of three miles.

"(9) The term 'contiguous zone' means the entire zone established or to be established by the United States under article 24 of the Convention of the Territorial Sea and the Contiguous Zone.

"(10) The term 'ocean' means any portion of the high seas beyond the contiguous zone.

"(11) The term 'effluent limitation' means any restriction established by a State or the Administrator on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters, the waters of the contiguous zone, or the ocean, including schedules of compliance.

"(12) The term 'discharge of a pollutant' and the term 'discharge of pollutants' each means (A) any addition of any pollutant to navigable waters from any point source, (B) any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft.

"(13) The term 'toxic pollutant' means those pollutants, or combinations of pollutants, including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information available to the Administrator, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring.

"(14) The term 'point source' means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.

"(15) The term 'biological monitoring' shall mean the determination of the effects on aquatic life, including accumulation of pollutants in tissue, in receiving waters due to the discharge of pollutants (A) by techniques and procedures, including sampling of organisms representative of appropriate levels of the food chain appropriate to the volume and the physical, chemical, and biological characteristics of the effluent, and (B) at appropriate frequencies and locations.

"(16) The term 'discharge' when used without qualification includes a discharge of a pollutant, and a discharge of pollutants.

"(17) The term 'schedule of compliance' means a schedule of remedial measures including an enforceable sequence of actions or operations leading to compliance with an effluent limitation, other limitation, prohibition, or standard.

"(18) The term 'industrial user' means those industries identified in the Standard Industrial Classification Manual, Bureau of the Budget, 1967, as amended and supplemented, under the category 'Division D—Manufacturing' and such other classes of significant waste producers as, by regulation, the Administrator deems appropriate.

"(19) The term 'pollution' means the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.

"WATER POLLUTION CONTROL ADVISORY BOARD

"SEC. 503. (a) (1) There is hereby established in the Environmental Protection Agency a Water Pollution Control Advisory Board, composed of the Administrator or his designee, who shall be Chairman, and nine members appointed by the President, none of whom shall be Federal officers or employees. The appointed members, having due regard for the purposes of this Act, shall be selected from among representatives of various State, interstate, and local governmental agencies, of public or private interests contributing to, affected by, or

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concerned with pollution, and of other public and private agencies, organizations, or groups demonstrating an active interest in the field of pollution prevention and control, as well as other individuals who are expert in this field.

"(2)(A) Each member appointed by the President shall hold office for a term of three years, except that (i) any member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed for the remainder of such term, and (ii) the terms of office of the members first taking office after June 30, 1956, shall expire as follows: three at the end of one year after such date, three at the end of two years after such date, and three at the end of three years after such date, as designated by the President at the time of appointment, and (iii) the term of any member under the preceding provisions shall be extended until the date on which his successor's appointment is effective. None of the members appointed by the President shall be eligible for reappointment within one year after the end of his preceding term.

"(B) The members of the Board who are not officers or employees of the United States, while attending conferences or meetings of the Board or while otherwise serving at the request of the Administrator, shall be entitled to receive compensation at a rate to be fixed by the Administrator, but not exceeding $100 per diem, including travel-time, and while away from their homes or regular places of business they may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by law (5 U.S.C. 73b–2) for persons in the Government service employed intermittently.

"(b) The Board shall advise, consult with, and make recommendations to the Administrator on matters of policy relating to the activities and functions of the Administrator under this Act.

"(c) Such clerical and technical assistance as may be necessary to discharge the duties of the Board shall be provided from the personnel of the Environmental Protection Agency.

"EMERGENCY POWERS

"SEC. 504. Notwithstanding any other provision of this Act, the Administrator upon receipt of evidence that a pollution source or combination of sources is presenting an imminent and substantial endangerment to the health of persons or to the welfare of persons where such endangerment is to the livelihood of such persons, such as inability to market shellfish, may bring suit on behalf of the United States in the appropriate district court to immediately restrain any person causing or contributing to the alleged pollution to stop the discharge of pollutants causing or contributing to such pollution or to take such other action as may be necessary.

"CITIZEN SUITS

"SEC. 505. (a) Except as provided in subsection (b) of this section, any citizen may commence a civil action on his own behalf—

"(1) against any person (including (i) the United States, and (ii) any other governmental instrumentality or agency to the extent permitted by the eleventh amendment to the Constitution) who is alleged to be in violation of (A) an effluent standard or limitation under this Act or (B) an order issued by the Administrator or a State with respect to such a standard or limitation, or

"(2) against the Administrator where there is alleged a failure of the Administrator to perform any act or duty under this Act which is not discretionary with the Administrator.

The district courts shall have jurisdiction, without regard to the amount in controversy or the citizenship of the parties, to enforce such an effluent standard or limitation, or such an order, or to order the Administrator to perform such act or duty, as the case may be, and to apply any appropriate civil penalties under section 309(d) of this Act.

"(b) No action may be commenced—

"(1) under subsection (a)(1) of this section—

"(A) prior to sixty days after the plaintiff has given notice of the alleged violation (i) to the Administrator, (ii) to the State in which the alleged violation occurs, and (iii) to any alleged violator of the standard, limitation, or order, or

"(B) if the Administrator or State has commenced and is diligently prosecuting a civil or criminal action in a court of the United States, or a State to require compliance with the standard, limitation, or order, but in any such action in a court of the United States any citizen may intervene as a matter of right.

"(2) under subsection (a)(2) of this section prior to sixty days after the plaintiff has given notice of such action to the Administrator,

except that such action may be brought immediately after such notification in the case of an action under this section respecting a violation of sections 306 and 307(a) of this Act. Notice under this subsection shall be given in such manner as the Administrator shall prescribe by regulation.

"(c)(1) Any action respecting a violation by a discharge source of an effluent standard or limitation or an order respecting such standard or limitation may be brought under this section only in the judicial district in which such source is located.

"(2) In such action under this section, the Administrator, if not a party, may intervene as a matter of right.

"(d) The court, in issuing any final order in any action brought pursuant to this section, may award costs of litigation (including reasonable attorney and expert witness fees) to any party, whenever the court determines such award is appropriate. The court may, if a temporary restraining order or preliminary injunction is sought, require the filing of a bond or equivalent security in accordance with the Federal Rules of Civil Procedure.

"(e) Nothing in this section shall restrict any right which any person (or class of persons) may have under any statute or common law to seek enforcement of any effluent standard or limitation or to seek any other relief (including relief against the Administrator or a State agency).

"(f) For purposes of this section, the term 'effluent standard or limitation under this Act' means (1) effective July 1, 1973, an unlawful act under subsection (a) of section 301 of this Act; (2) an effluent limitation or other limitation under section 301 or 302 of this Act; (3) standard of performance under section 306 of this Act; (4) prohibition, effluent standard or pretreatment standards under section 307 of this Act; (5) certification under section 401 of this Act; or (6) a permit or condition thereof issued under section 402 of this Act, which is in effect under this Act (including a requirement applicable by reason of section 313 of this Act).

"(g) For the purposes of this section the term 'citizen' means a person or persons having an interest which is or may be adversely affected.

"(h) A Governor of a State may commence a civil action under subsection (a), without regard to the limitations of subsection (b) of this section, against the Administrator where there is alleged a failure of the Administrator to enforce an effluent standard or limitation under this Act the violation of which is occurring in another State and is causing an adverse effect on the public health or welfare in his State, or is causing a violation of any water quality requirement in his State.

"APPEARANCE

"SEC. 506. The Administrator shall request the Attorney General to appear and represent the United States in any civil or criminal action instituted under this Act to which the Administrator is a party. Unless the Attorney General notifies the Administrator within a reasonable time, that he will appear in a civil action, attorneys who are officers or employees of the Environmental Protection Agency shall appear and represent the United States in such action.

"EMPLOYEE PROTECTION

"SEC. 507. (a) No person shall fire, or in any other way discriminate against, or cause to be fired or discriminated against, any employee or any authorized representative of employees by reason of the fact that such employee or representative has filed, instituted, or caused to be filed or instituted any proceeding under this Act, or has testified or is about to testify in any proceeding resulting from the administration or enforcement of the provisions of this Act.

"(b) Any employee or a representative of employees who believes that he has been fired or otherwise discriminated against by any person in violation of subsection (a) of this section may, within thirty days after such alleged violation occurs, apply to the Secretary of Labor for a review of such firing or alleged discrimination. A copy of the application shall be sent to such person who shall be the respondent. Upon receipt of such application, the Secretary of Labor shall cause such investigation to be made as he deems appropriate. Such investigation shall provide an opportunity for a public hearing at the request of any party to such review to enable the parties to present information relating to such alleged violation. The parties shall be given written notice of the time and place of the hearing at least five days prior to the hearing. Any such hearing shall be of record and shall be subject to section 554 of title 5 of the United States Code. Upon receiving the report of such investigation, the Secretary of Labor shall make findings of fact. If he finds that such violation did occur, he shall issue a decision, incorporating an order therein and his findings, requiring the party committing such violation to take such affirmative action to abate the violation as the Secretary of Labor deems appropriate, including, but not limited to, the rehiring or reinstatement of the employee or representative of employees to his former position with compensation. If he finds that there was no such violation, he shall issue an order denying the application. Such order issued by the Secretary of Labor under this subparagraph shall be subject to judicial review in the same manner as orders and decisions of the Administrator are subject to judicial review under this Act.

"(c) Whenever an order is issued under this section to abate such violation, at the request of the applicant, a sum equal to the aggregate amount of all costs and expenses (including the attorney's fees), as determined by the Secretary of Labor, to have been reasonably incurred by the applicant for, or in connection with, the institution and prosecution of such proceedings, shall be assessed against the person committing such violation.

"(d) This section shall have no application to any employee who, acting without direction from his employer (or his agent) deliberately

violates any prohibition of effluent limitation or other limitaton under section 301 or 302 of this Act, standards of performance under section 306 of this Act, effluent standard, prohibition or pretreatment standard under section 307 of this Act, or any other prohibition or limitation established under this Act.

"(e) The Administrator shall conduct continuing evaluations of potential loss or shifts of employment which may result from the issuance of any effluent limitation or order under this Act, including, where appropriate, investigating threatened plant closures or reductions in employment allegedly resulting from such limitation or order. Any employee who is discharged or laid-off, threatened with discharge or lay-off, or otherwise discriminated against by any person because of the alleged results of any effluent limitation or order issued under this Act, or any representative of such employee, may request the Administrator to conduct a full investigation of the matter. The Administrator shall thereupon investigate the matter and, at the request of any party, shall hold public hearings on not less than five days notice, and shall at such hearings require the parties, including the employer involved, to present information relating to the actual or potential effect of such limitation or order on employment and on any alleged discharge, lay-off, or other discrimination and the detailed reasons or justification therefor. Any such hearing shall be of record and shall be subject to section 554 of title 5 of the United States Code. Upon receiving the report of such investigation, the Administrator shall make findings of fact as to the effect of such effluent limitation or order on employment and on the alleged discharge, lay-off, or discrimination and shall make such recommendations as he deems appropriate. Such report, findings, and recommendations shall be available to the public. Nothing in this subsection shall be construed to require or authorize the Administrator to modify or withdraw any effluent limitation or order issued under this Act.

"FEDERAL PROCUREMENT

"SEC. 508. (a) No Federal agency may enter into any contract with any person, who has been convicted of any offense under section 309 (c) of this Act, for the procurement of goods, materials, and services if such contract is to be performed at any facility at which the violation which gave rise to such conviction occurred, and if such facility is owned, leased, or supervised by such person. The prohibition in the preceding sentence shall continue until the Administrator certifies that the condition giving rise to such conviction has been corrected.

"(b) The Administrator shall establish procedures to provide all Federal agencies with the notification necessary for the purposes of subsection (a) of this section.

"(c) In order to implement the purposes and policy of this Act to protect and enhance the quality of the Nation's water, the President shall, not more than one hundred and eighty days after enactment of this Act, cause to be issued an order (1) requiring each Federal agency authorized to enter into contracts and each Federal agency which is empowered to extend Federal assistance by way of grant, loan, or contract to effectuate the purpose and policy of this Act in such contracting or assistance activities, and (2) setting forth procedures, sanctions, penalties, and such other provisions, as the President determines necessary to carry out such requirement.

"(d) The President may exempt any contract, loan, or grant from all or part of the provisions of this section where he determines such exemption is necessary in the paramount interest of the United States and he shall notify the Congress of such exemption.

"(e) The President shall annually report to the Congress on measures taken in compliance with the purpose and intent of this section, including, but not limited to, the progress and problems associated with such compliance.

"ADMINISTRATIVE PROCEDURE AND JUDICIAL REVIEW

"SEC. 509. (a)(1) For purposes of obtaining information under section 305 of this Act, or carrying out section 507(e) of this Act, the Administrator may issue subpenas for the attendance and testimony of witnesses and the production of relevant papers, books, and documents, and he may administer oaths. Except for effluent data, upon a showing satisfactory to the Administrator that such papers, books, documents, or information or particular part thereof, if made public, would divulge trade secrets or secret processes, the Administrator shall consider such record, report, or information or particular portion thereof confidential in accordance with the purposes of section 1905 of title 18 of the United States Code, except that such paper, book, document, or information may be disclosed to other officers, employees, or authorized representatives of the United States concerned with carrying out this Act, or when relevant in any proceeding under this Act. Witnesses summoned shall be paid the same fees and mileage that are paid witnesses in the courts of the United States. In case of contumacy or refusal to obey a subpena served upon any person under this subsection, the district court of the United States for any district in which such person is found or resides or transacts business, upon application by the United States and after notice to such person, shall have jurisdiction to issue an order requiring such person to appear and give testimony before the Administrator, to appear and produce papers, books, and documents before the Administrator, or both, and any failure to obey such order of the court may be punished by such court as a contempt thereof.

"(2) The district courts of the United States are authorized, upon application by the Administrator, to issue subpenas for attendance and testimony of witnesses and the production of relevant papers, books, and documents, for purposes of obtaining information under sections 304 (b) and (c) of this Act. Any papers, books, documents, or other information or part thereof, obtained by reason of such a subpena shall be subject to the same requirements as are provided in paragraph (1) of this subsection.

"(b)(1) Review of the Administrator's action (A) in promulgating any standard of performance under section 306, (B) in making any determination pursuant to section 306(b)(1)(C), (C) in promulgating any effluent standard, prohibition, or pretreatment standard under section 307, (D) in making any determination as to a State permit program submitted under section 402(b), (E) in approving or promulgating any effluent limitation or other limitation under section 301, 302, or 306, and (F) in issuing or denying any permit under section 402, may be had by any interested person in the Circuit Court of Appeals of the United States for the Federal judicial district in which such person resides or transacts such business upon application by such person. Any such application shall be made within ninety days from the date of such determination, approval, promulgation, issuance or denial, or after such date only if such application is based solely on grounds which arose after such ninetieth day.

"(2) Action of the Administrator with respect to which review could have been obtained under paragraph (1) of this subsection shall not be subject to judicial review in any civil or criminal proceeding for enforcement.

"(c) In any judicial proceeding brought under subsection (b) of this section in which review is sought of a determination under this Act required to be made on the record after notice and opportunity for hearing, if any party applies to the court for leave to adduce additional evidence, and shows to the satisfaction of the court that such additional evidence is material and that there were reasonable grounds for the failure to adduce such evidence in the proceeding before the Administrator, the court may order such additional evidence (and evidence in rebuttal thereof) to be taken before the Administrator, in such manner and upon such terms and conditions as the court may deem proper. The Administrator may modify his findings as to the facts, or make new findings, by reason of the additional evidence so taken and he shall file such modified or new findings, and his recommendation, if any, for the modification or setting aside of his original determination, with the return of such additional evidence.

"STATE AUTHORITY

"SEC. 510. Except as expressly provided in this Act, nothing in this Act shall (1) preclude or deny the right of any State or political subdivision thereof or interstate agency to adopt or enforce (A) any standard or limitation respecting discharges of pollutants, or (B) any requirement respecting control or abatement of pollution; except that if an effluent limitation, or other limitation, effluent standard, prohibition, pretreatment standard, or standard of performance is in effect under this Act, such State or political subdivision or interstate agency may not adopt or enforce any effluent limitation, or other limitation, effluent standard, prohibition, pretreatment standard, or standard of performance which is less stringent than the effluent limitation, or other limitation, effluent standard, prohibition, pretreatment standard, or standard of performance under this Act; or (2) be construed as impairing or in any manner affecting any right or jurisdiction of the States with respect to the waters (including boundary waters) of such States.

"OTHER AFFECTED AUTHORITY

"SEC. 511. (a) This Act shall not be construed as (1) limiting the authority or functions of any officer or agency of the United States under any other law or regulation not inconsistent with this Act; (2) affecting or impairing the authority of the Secretary of the Army (A) to maintain navigation or (B) under the Act of March 3, 1899 (30 Stat. 1112); except that any permit issued under section 404 of this Act shall be conclusive as to the effect on water quality of any discharge resulting from any activity subject to section 10 of the Act of March 3, 1899, or (3) affecting or impairing the provisions of any treaty of the United States.

"(b) Discharges of pollutants into the navigable waters subject to the Rivers and Harbors Act of 1910 (36 Stat. 593; 33 U.S.C. 421) and the Supervisory Harbors Act of 1888 (25 Stat. 209; 33 U.S.C. 441–451b) shall be regulated pursuant to this Act, and not subject to such Act of 1910 and the Act of 1888 except as to effect on navigation and anchorage.

"(c)(1) Except for the provision of Federal financial assistance for the purpose of assisting the construction of publicly owned treatment works as authorized by section 201 of this Act, and the issuance of a permit under section 402 of this Act for the discharge of any

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pollutant by a new source as defined in section 306 of this Act, no action of the Administrator taken pursuant to this Act shall be deemed a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969 (83 Stat. 852); and

"(2) Nothing in the National Environmental Policy Act of 1969 (83 Stat. 852) shall be deemed to—

"(A) authorize any Federal agency authorized to license or permit the conduct of any activity which may result in the discharge of a pollutant into the navigable waters to review any effluent limitation or other requirement established pursuant to this Act or the adequacy of any certification under section 401 of this Act; or

"(B) authorize any such agency to impose, as a condition precedent to the issuance of any license or permit, any effluent limitation other than any such limitation established pursuant to this Act.

(d) Notwithstanding this Act or any other provision of law, the Administrator (1) shall not require any State to consider in the development of the ranking in order of priority of needs for the construction of treatment works (as defined in title II of this Act), any water pollution control agreement which may have been entered into between the United States and any other nation, and (2) shall not consider any such agreement in the approval of any such priority ranking.

"SEPARABILITY

"SEC. 512. If any provision of this Act, or the application of any provision of this Act to any person or circumstance, is held invalid, the application of such provision to other persons or circumstances, and the remainder of this Act, shall not be affected thereby.

"LABOR STANDARDS

"SEC. 513. The Administrator shall take such action as may be necessary to insure that all laborers and mechanics employed by contractors or subcontractors on treatment works for which grants are made under this Act shall be paid wages at rates not less than those prevailing for the same type of work on similar construction in the immediate locality, as determined by the Secretary of Labor, in accordance with the Act of March 3, 1931, as amended, known as the Davis-Bacon Act (46 Stat. 1494; 40 U.S.C., sec. 276a through 276a-5). The Secretary of Labor shall have, with respect to the labor standards specified in this subsection, the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (15 F.R. 3176) and section 2 of the Act of June 13, 1934, as amended (48 Stat. 948; 40 U.S.C. 276c).

"PUBLIC HEALTH AGENCY COORDINATION

"SEC. 514. The permitting agency under section 402 shall assist the applicant for a permit under such section in coordinating the requirements of this Act with those of the appropriate public health agencies.

"EFFLUENT STANDARDS AND WATER QUALITY INFORMATION ADVISORY COMMITTEE

"SEC. 515. (a) (1) There is established on Effluent Standards and Water Quality Information Advisory Committee, which shall be composed of a Chairman and eight members who shall be appointed by the Administrator within sixty days after the date of enactment of this Act.

"(2) All members of the Committee shall be selected from the scientific community, qualified by education, training, and experience to provide, assess, and evaluate scientific and technical information on effluent standards and limitations.

"(3) Members of the Committee shall serve for a term of four years, and may be reappointed.

"(b) (1) No later than one hundred and eighty days prior to the date on which the Administrator is required to publish any proposed regulations required by section 304(b) of this Act, any proposed standard of performance for new sources required by section 306 of this Act, or any proposed toxic effluent standard required by section 307 of this Act, he shall transmit to the Committee a notice of intent to propose such regulations. The Chairman of the Committee within ten days after receipt of such notice may publish a notice of a public hearing by the Committee, to be held within thirty days.

"(2) No later than one hundred and twenty days after receipt of such notice, the Committee shall transmit to the Administrator such scientific and technical information as is in its possession, including that presented at any public hearing, related to the subject matter contained in such notice.

"(3) Information so transmitted to the Administrator shall constitute a part of the administrative record and comments on any proposed regulations or standards as information to be considered with other comments and information in making any final determinations.

"(4) In preparing information for transmittal, the Committee shall avail itself of the technical and scientific services of any Federal agency, including the United States Geological Survey and any national environmental laboratories which may be established.

"(c) (1) The Committee shall appoint and prescribe the duties of a Secretary, and such legal counsel as it deems necessary. The Committee shall appoint such other employees as it deems necessary to exercise and fulfill its powers and responsibilities. The compensation of all employees appointed by the Committee shall be fixed in accordance with chapter 51 and subchapter III of chapter 53 of title V of the United States Code.

"(2) Members of the Committee shall be entitled to receive compensation at a rate to be fixed by the President but not in excess of the maximum rate of pay for grade GS-18, as provided in the General Schedule under section 5332 of title V of the United States Code.

"(d) Five members of the Committee shall constitute a quorum, and official actions of the Committee shall be taken only on the affirmative vote of at least five members. A special panel composed of one or more members upon order of the Committee shall conduct any hearing authorized by this section and submit the transcript of such hearing to the entire Committee for its action thereon.

"(e) The Committee is authorized to make such rules as are necessary for the orderly transaction of its business.

"REPORTS TO CONGRESS

"SEC. 516. (a) Within ninety days following the convening of each session of Congress, the Administrator shall submit to the Congress a report, in addition to any other report required by this Act, on measures taken toward implementing the objective of this Act, including, but not limited to, (1) the progress and problems associated with developing comprehensive plans under section 102 of this Act, area-wide plans under section 208 of this Act, basin plans under section 209 of this Act, and plans under section 303(e) of this Act; (2) a summary of actions taken and results achieved in the field of water pollution control research, experiments, studies, and related matters by the Administrator and other Federal agencies and by other persons and agencies under Federal grants or contracts; (3) the progress and problems associated with the development of effluent limitations and recommended control techniques; (4) the status of State programs, including a detailed summary of the progress obtained as compared to that planned under State program plans for development and enforcement of water quality requirements; (5) the identification and status of enforcement actions pending or completed under such Act during the preceding year; (6) the status of State, interstate, and local pollution control programs established pursuant to, and assisted by, this Act; (7) a summary of the results of the survey required to be taken under section 210 of this Act; (8) his activities including recommendations under sections 109 through 111 of this Act; and (9) all reports and recommendations made by the Water Pollution Control Advisory Board.

(b) (1) The Administrator, in cooperation with the States, including water pollution control agencies and other water pollution control planning agencies, shall make (A) a detailed estimate of the cost of carrying out the provisions of this Act; (B) a detailed estimate, biennially revised, of the cost of construction of all needed publicly owned treatment works in all of the States and of the cost of construction of all needed publicly owned treatment works in each of the States; (C) a comprehensive study of the economic impact on affected units of government of the cost of installation of treatment facilities; and (D) a comprehensive analysis of the national requirements for and the cost of treating municipal, industrial, and other effluent to attain the water quality objectives as established by this Act or applicable State law. The Administrator shall submit such detailed estimate and such comprehensive study of such cost to the Congress no later than February 10 of each odd-numbered year. Whenever the Administrator, pursuant to this subsection, requests and receives an estimate of cost from a State, he shall furnish copies of such estimate together with such detailed estimate to Congress.

(2) Notwithstanding the second sentence of paragraph (1) of this subsection, the Administrator shall make a preliminary detailed estimate called for by subparagraph (B) of such paragraph and shall submit such preliminary detailed estimate to the Congress no later than September 3, 1974. The Administrator shall require each State to prepare an estimate of cost for such State, and shall utilize the survey form EPA-1, O.M.B. No. 158-R0017, prepared for the 1973 detailed estimate, except that such estimate shall include all costs of compliance with section 201 (g) (2) (A) of this Act and water quality standards established pursuant to section 303 of this Act, and all costs of treatment works as defined in section 212 (2), including all eligible costs of constructing sewage collection systems and correcting excessive infiltration or inflow and all eligible costs of correcting combined storm and sanitary sewer problems and treating storm water flows. The survey form shall be distributed by the Administrator to each State no later that January 31, 1974.

"GENERAL AUTHORIZATION

"SEC. 517. There are authorized to be appropriated to carry out this Act, other than sections 104, 105, 106(a), 107, 108, 112, 113, 114, 115,

206, 207, 208 (f) and (h), 209, 304, 311 (c), (d), (i), (l), and (k), 314, 315, and 317, $250,000,000 for the fiscal year ending June 30, 1973, $300,000,000 for the fiscal year ending June 30, 1974, and $350,000,000 for the fiscal year ending June 30, 1975.

"SHORT TITLE

"SEC. 518. This Act may be cited as the 'Federal Water Pollution Control Act'."

AUTHORIZATIONS FOR FISCAL YEAR 1972

SEC. 3. (a) There is authorized to be appropriated for the fiscal year ending June 30, 1972, and to exceed $11,000,000 for the purpose of carrying out section 5(n) (other than for salaries and related expenses) of the Federal Water Pollution Control Act as it existed immediately prior to the date of the enactment of the Federal Water Pollution Control Act Amendments of 1972.

(b) There is hereby authorized to be appropriated for the fiscal year ending June 30, 1972, and to exceed $350,000,000 for the purpose of making grants under section 8 of the Federal Water Pollution Control Act as it existed immediately prior to the date of the enactment of the Federal Water Pollution Control Act Amendments of 1972.

(c) The Federal share of all grants made under section 8 of the Federal Water Pollution Control Act as it existed immediately prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972 from sums herein and heretofore authorized for the fiscal year ending June 30, 1972, shall be that authorized by section 202 of such Act as established by the Federal Water Pollution Control Act Amendments of 1972.

(d) Sums authorized by this section shall be in addition to any amounts heretofore authorized for such fiscal year for sections 5(n) and 8 of the Federal Water Pollution Control Act as it existed immediately prior to the date of enactment of the Federal Water Pollution Control Act Amendments of 1972.

SAVINGS PROVISION

SEC. 4. (a) No suit, action, or other proceeding lawfully commenced by or against the Administrator or any other officer or employee of the United States in his official capacity or in relation to the discharge of his official duties under the Federal Water Pollution Control Act as in effect immediately prior to the date of enactment of this Act shall abate by reason of the taking effect of the amendment made by section 2 of this Act. The court may, on its own motion or that of any party made at any time within twelve months after such taking effect, allow the same to be maintained by or against the Administrator or such officer or employee.

(b) All rules, regulations, orders, determinations, contracts, certifications, authorizations, delegations, or other actions duly issued, made, or taken by or pursuant to the Federal Water Pollution Control Act as in effect immediately prior to the date of enactment of this Act, and pertaining to any functions, powers, requirements, and duties under the Federal Water Pollution Control Act as in effect immediately prior to the date of enactment of this Act, shall continue in full force and effect after the date of enactment of this Act until modified or rescinded in accordance with the Federal Water Pollution Control Act as amended by this Act.

(c) The Federal Water Pollution Control Act as in effect immediately prior to the date of enactment of this Act shall remain applicable to all grants made from funds authorized for the fiscal year ending June 30, 1972, and prior fiscal years, including any increases in the monetary amount of any such grant which may be paid from authorizations for fiscal years beginning after June 30, 1972, except as specifically otherwise provided in section 202 of the Federal Water Pollution Control Act as amended by this Act and in subsection (c) of section 3 of this Act.

OVERSIGHT STUDY

SEC. 5. In order to assist the Congress in the conduct of oversight responsibilities the Comptroller General of the United States shall conduct a study and review of the research, pilot, and demonstration programs related to prevention and control of water pollution, including waste treatment and disposal techniques, which are conducted, supported, or assisted by any agency of the Federal Government pursuant to any Federal law or regulation and assess conflicts between, and the coordination and efficacy of, such programs, and make a report to the Congress thereon by October 1, 1973.

INTERNATIONAL TRADE STUDY

SEC. 6. (a) The Secretary of Commerce, in cooperation with other interested Federal agencies and with representatives of industry and the public, shall undertake immediately an investigation and study to determine—

(1) the extent to which pollution abatement and control programs will be imposed on, or voluntarily undertaken by, United States manufacturers in the near future and the probable short- and long-range effects of the costs of such programs (computed to the greatest extent practicable on an industry-by-industry basis) on (A) the production costs of such domestic manufacturers, and (B) the market prices of the goods produced by them;

(2) the probable extent to which pollution abatement and control programs will be implemented in foreign industrial nations in the near future and the extent to which the production costs (computed to the greatest extent practicable on an industry-by-industry basis) of foreign manufacturers will be affected by the costs of such programs;

(3) the probable competitive advantage which any article manufactured in a foreign nation will likely have in relation to a comparable article made in the United States if that foreign nation—

(A) does not require its manufacturers to implement pollution abatement and control programs,

(B) requires a lesser degree of pollution abatement and control in its programs, or

(C) in any way reimburses or otherwise subsidizes its manufacturers for the costs of such program;

(4) alternative means by which any competitive advantage accruing to the products of any foreign nation as a result of any factor described in paragraph (3) may be (A) accurately and quickly determined, and (B) equalized, for example, by the imposition of a surcharge or duty, on a foreign product in an amount necessary to compensate for such advantage; and

(5) the impact, if any, which the imposition of a compensating tariff of other equalizing measure may have in encouraging foreign nations to implement pollution and abatement control programs.

(b) The Secretary shall make an initial report to the President and Congress within six months after the date of enactment of this section of the results of the study and investigation carried out pursuant to this section and shall make additional reports thereafter at such times as he deems appropriate taking into account the development of relevant data, but not less than once every twelve months.

INTERNATIONAL AGREEMENTS

SEC. 7. The President shall undertake to enter into international agreements to apply uniform standards of performance for the control of the discharge and emission of pollutants from new sources, uniform controls over the discharge and emission of toxic pollutants, and uniform controls over the discharge of pollutants into the ocean. For this purpose the President shall negotiate multilateral treaties, conventions, resolutions, or other agreements, and formulate, present, or support proposals at the United Nations and other appropriate international forums.

LOANS TO SMALL BUSINESS CONCERNS FOR WATER POLLUTION CONTROL FACILITY

SEC. 8. (a) Section 7 of the Small Business Act is amended by inserting at the end thereof a new subsection as follows:

"(g)(1) The Administration also is empowered to make loans (either directly or in cooperation with banks or other lenders through agreements to participate on an immediate or deferred basis) to assist any small business concern in affecting additions to or alterations in the equipment, facilities (including the construction of pretreatment facilities and interceptor sewers), or methods of operation of such concern to meet water pollution control requirements established under the Federal Water Pollution Control Act, if the Administration determines that such concern is likely to suffer substantial economic injury without assistance under this subsection.

"(2) Any such loan—

"(A) shall be made in accordance with provisions applicable to loans made pursuant to subsection (b)(5) of this section, except as otherwise provided in this subsection;

"(B) shall be made only if the applicant furnishes the Administration with a statement in writing from the Environmental Protection Agency or, if appropriate, the State, that such additions or alterations are necessary and adequate to comply with requirements established under the Federal Water Pollution Control Act.

"(3) The Administrator of the Environmental Protection Agency shall, as soon as practicable after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972 and not later than one hundred and eighty days thereafter, promulgate regulations establishing uniform rules for the issuance of statements for the purpose of paragraph (2)(B) of this subsection.

"(4) There is authorized to be appropriated to the disaster loan fund established pursuant to section 4(c) of this Act not to exceed $800,000,000 solely for the purpose of carrying out this subsection."

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(b) Section 4(c)(1)(A) of the Small Business Act is amended striking out "and 7(c)(2)" and inserting in lieu thereof "7(c)(2), d 7(g)".

ENVIRONMENTAL COURT

SEC. 9. The President, acting through the Attorney General, shall make a full and complete investigation and study of the feasibility of establishing a separate court, or court system, having jurisdiction over environmental matters and shall report the results of such investigation and study together with his recommendations to Congress not later than one year after the date of enactment of this Act.

NATIONAL POLICIES AND GOALS STUDY

SEC. 10. The President shall make a full and complete investigation and study of all of the national policies and goals established by law for the purpose of determining what the relationship should be between these policies and goals, taking into account the resources of the Nation. He shall report the results of such investigation and study together with his recommendations to Congress not later than two years after the date of enactment of this Act. There is authorized to be appropriated not to exceed $5,000,000 to carry out the purposes of this section.

EFFICIENCY STUDY

SEC. 11. The President shall conduct a full and complete investigation and study of ways and means of utilizing in the most effective manner all of the various resources, facilities, and personnel of the Federal Government in order most efficiently to carry out the objective of the Federal Water Pollution Control Act. He shall utilize in conducting such investigation and study, the General Accounting Office. He shall report the results of such investigation and study together with his recommendations to Congress not later than two hundred and seventy days after the date of enactment of this Act.

ENVIRONMENTAL FINANCING

SEC. 12. (a) This section may be cited as the "Environmental Financing Act of 1972".

(b) There is hereby created a body corporate to be known as the Environmental Financing Authority, which shall have succession until dissolved by Act of Congress. The Authority shall be subject to the general supervision and direction of the Secretary of the Treasury. The Authority shall be an instrumentality of the United States Government and shall maintain such offices as may be necessary or appropriate in the conduct of its business.

(c) The purpose of this section is to assure that inability to borrow necessary funds on reasonable terms does not prevent any State or local public body from carrying out any project for construction of waste treatment works determined eligible for assistance pursuant to subsection (e) of this section.

(d)(1) The Authority shall have a Board of Directors consisting of five persons, one of whom shall be the Secretary of the Treasury or his designee as Chairman of the Board, and four of whom shall be appointed by the President from among the officers or employees of the Authority or of any department or agency of the United States Government.

(2) The Board of Directors shall meet at the call of its Chairman. The Board shall determine the general policies which shall govern the operations of the Authority. The Chairman of the Board shall select and effect the appointment of qualified persons to fill the offices as may be provided for in the bylaws, with such executive functions, powers, and duties as may be prescribed by the bylaws or by the Board of Directors, and such persons shall be the executive officers of the Authority and shall discharge all such executive functions, powers, and duties. The members of the Board, as such, shall not receive compensation for their services.

(e)(1) Until July 1, 1975, the Authority is authorized to make commitments to purchase, and to purchase on terms and conditions determined by the Authority, any obligation or participation therein which is issued by a State or local public body to finance the non-Federal share of the cost of any project for the construction of waste treatment works which the Administrator of the Environmental Protection Agency has determined to be eligible for Federal financial assistance under the Federal Water Pollution Control Act.

(2) No commitment shall be entered into, and no purchase shall be made, unless the Administrator of the Environmental Protection Agency (A) has certified that the public body is unable to obtain on reasonable terms sufficient credit to finance its actual needs; (B) has approved the project as eligible under the Federal Water Pollution Control Act; and (C) has agreed to guarantee timely payment of principal and interest on the obligation. The Administrator is authorized to guarantee such timely payments and to issue regulations as he deems necessary and proper to protect such guarantees. Appropriations are hereby authorized to be made to the Administrator in such sums as are necessary to make payments under such guarantees, and such payments are authorized to be made from such appropriations.

(3) No purchase shall be made of obligations issued to finance projects, the permanent financing of which occurred prior to the enactment of this section.

(4) Any purchase by the Authority shall be upon such terms and conditions as to yield a return at a rate determined by the Secretary of the Treasury taking into consideration (A) the current average yield on outstanding marketable obligations of the United States of comparable maturity or in its stead whenever the Authority has sufficient of its own long-term obligations outstanding, the current average yield on outstanding obligations of the Authority of comparable maturity; and (B) the market yields on municipal bonds.

(5) The Authority is authorized to charge fees for its commitments and other services adequate to cover all expenses and to provide for the accumulation of reasonable contingency reserves and such fees shall be included in the aggregate project costs.

(f) To provide initial capital to the Authority the Secretary of the Treasury is authorized to advance the funds necessary for this purpose. Each such advance shall be upon such terms and conditions as to yield a return at a rate not less than a rate determined by the Secretary of the Treasury taking into consideration the current average yield on outstanding marketable obligations of the United States of comparable maturities. Interest payments on such advances may be deferred, at the discretion of the Secretary, but any such deferred payments shall themselves bear interest at the rate specified in this section. There is authorized to be appropriated not to exceed $100,000,000, which shall be available for the purposes of this subsection.

(g)(1) The Authority is authorized, with the approval of the Secretary of the Treasury, to issue and have outstanding obligations having such maturities and bearing such rate or rates of interest as may be determined by the Authority. Such obligations may be redeemable at the option of the Authority before maturity in such manner as may be stipulated therein.

(2) As authorized in appropriation Acts, and such authorizations may be without fiscal year limitation, the Secretary of the Treasury may in his discretion purchase or agree to purchase any obligations issued pursuant to paragraph (1) of this subsection, and for such purpose the Secretary of the Treasury is authorized to use as a public debt transaction the proceeds of the sale of any securities hereafter issued under the Second Liberty Bond Act, as now or hereafter in force, and the purposes for which securities may be issued under the Second Liberty Bond Act as now or hereafter in force, are extended to include such purchases. Each purchase of obligations by the Secretary of the Treasury under this subsection shall be upon such terms and conditions as to yield a return at a rate not less than a rate determined by the Secretary of the Treasury, taking into consideration the current average yield on outstanding marketable obligations of the United States of comparable maturities. The Secretary of the Treasury may sell, upon such terms and conditions and at such price or prices as he shall determine, any of the obligations acquired by him under this paragraph. All purchases and sales by the Secretary of the Treasury of such obligations under this paragraph shall be treated as public debt transactions of the United States.

(h) The Secretary of the Treasury is authorized and directed to make annual payments to the Authority in such amounts as are necessary to equal the amount by which the dollar amount of interest expense accrued by the Authority on account of its obligations exceeds the dollar amount of interest income accrued by the Authority on account of obligations purchased by it pursuant to subsection (e) of this section.

(i) The Authority shall have power—

(1) to sue and be sued, complain and defend, in its corporate name;

(2) to adopt, alter, and use a corporate seal, which shall be judicially noticed;

(3) to adopt, amend, and repeal bylaws, rules, and regulations as may be necessary for the conduct of its business;

(4) to conduct its business, carry on its operations, and have offices and exercise the powers granted by this section in any State without regard to any qualification or similar statute in any State;

(5) to lease, purchase, or otherwise acquire, own, hold, improve, use, or otherwise deal in and with any property, real, personal, or mixed, or any interest therein, wherever situated;

(6) to accept gifts or donations of services, or of property, real, personal, or mixed, tangible or intangible, in aid of any of the purposes of the Authority;

(7) to sell, convey, mortgage, pledge, lease, exchange, and otherwise dispose of its property and assets;

(8) to appoint such officers, attorneys, employees, and agents as may be required, to define their duties, to fix and to pay such compensation for their services as may be determined, subject to the civil service and classification laws, to require bonds for them and pay the premium thereof; and

(9) to enter into contracts, to execute instruments, to incur liabilities, and to do all things as are necessary or incidental to the proper management of its affairs and the proper conduct of its business.

(j) The Authority, its property, its franchise, capital, reserves, surplus, security holdings, and other funds, and its income shall be

exempt from all taxation now or hereafter imposed by the United States or by any State or local taxing authority; except that (A) any real property and any tangible personal property of the Authority shall be subject to Federal, State, and local taxation to the same extent according to its value as other such property is taxed, and (B) any and all obligations issued by the Authority shall be subject both as to principal and interest to Federal, State, and local taxation to the same extent as the obligations of private corporations are taxed.

(k) All obligations issued by the Authority shall be lawful investments, and may be accepted as security for all fiduciary, trust, and public funds, the investment or deposit of which shall be under authority or control of the United States or of any officer or officers thereof. All obligations issued by the Authority pursuant to this section shall be deemed to be exempt securities within the meaning of laws administered by the Securities and Exchange Commission, to the same extent as securities which are issued by the United States.

(l) In order to furnish obligations for delivery by the Authority, the Secretary of the Treasury is authorized to prepare such obligations in such form as the Authority may approve, such obligations when prepared to be held in the Treasury subject to delivery upon order by the Authority. The engraved plates, dies, bed pieces, and so forth, executed in connection therewith, shall remain in the custody of the Secretary of the Treasury. The Authority shall reimburse the Secretary of the Treasury for any expenditures made in the preparation, custody, and delivery of such obligations.

(m) The Authority shall, as soon as practicable after the end of each fiscal year, transmit to the President and the Congress an annual report of its operations and activities.

(n) The sixth sentence of the seventh paragraph of section 5136 of the Revised Statutes, as amended (12 U.S.C. 24), is amended by inserting "or obligations of the Environmental Financing Authority" immediately after "or obligations, participations, or other instruments of or issued by the Federal National Mortgage Association or the Government National Mortgage Association".

(o) The budget and audit provisions of the Government Corporation Control Act (31 U.S.C. 846) shall be applicable to the Environmental Financing Authority in the same manner as they are applied to the wholly owned Government corporations.

(p) Section 3689 of the Revised Statutes, as amended (31 U.S.C. 711), is further amended by adding a new paragraph following the last paragraph appropriating moneys for the purposes under the Treasury Department to read as follows:

"Payment to the Environmental Financing Authority: For payment to the Environmental Financing Authority under subsection (h) of the Environmental Financing Act of 1972."

SEX DISCRIMINATION

SEC. 13. No person in the United States shall on the ground of sex be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal assistance under this Act, the Federal Water Pollution Control Act, or the Environmental Financing Act. This section shall be enforced through agency provisions and rules similar to those already established, with respect to racial and other discrimination, under title VI of the Civil Rights Act of 1964. However, this remedy is not exclusive and will not prejudice or cut off any other legal remedies available to a discriminatee.

APPENDIX G

SELECT CALIFORNIA PLANNING

BASIN WATER QUALITY OBJECTIVES

KLAMATH RIVER BASIN - 1A

CHAPTER 4. WATER QUALITY OBJECTIVES

Section 13241, Division 7 of the California Water Code specifies that each Regional Board shall establish water quality objectives which, in the Regional Board's judgment, are necessary for the reasonable protection of the beneficial uses and for the prevention of nuisance.

Section 303 of the 1972 Amendments to the Federal Water Pollution Control Act requires the State to submit to the Administrator of the U. S. Environmental Protection Agency for his approval, all new or revised water quality standards which are established for surface and ocean waters. Under federal terminology, water quality standards consist of the beneficial uses enumerated on Table 2-1 and the water quality objectives contained in this chapter.

The water quality objectives contained herein are designed to satisfy all state and federal requirements.

As new information becomes available, the Regional Board will review the appropriateness of the objectives contained herein. These objectives will be subject to public hearing at least once during each 3-year period following adoption of this plan for the purpose of review and modification as appropriate.

EXISTING STATEWIDE PLANS AND POLICIES

The State Board has adopted a "Statement of Policy with Respect to Maintaining High Quality of Waters in California", the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California", the "Water Quality Control Plan for Ocean Waters of California", and the "Water Quality Control Policy for the Enclosed Bays and Estuaries of California". The Regional Board is required to implement the provisions of these plans and policies.

Nondegradation Policy

On October 28, 1968, the State Board adopted Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California". While requiring the continued maintenance of existing high quality waters, the policy provides conditions under which a change in water quality is allowable. A change must:

- be consistent with maximum benefit to the people of the State,
- not unreasonably affect present and anticipated beneficial uses of water, and
- not result in water quality less than that prescribed in water quality control plans or policies.

Thermal Plan

The "Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California", adopted by the State Board on May 18, 1972, specifies water quality objectives, effluent quality limits, and discharge prohibitions related to thermal characteristics of interstate waters and waste discharges.

Ocean Plan

The "Water Quality Control Plan for Ocean Waters of California" was adopted by the State Board on July 6, 1972. This plan establishes beneficial uses and water quality objectives for waters of the Pacific Ocean adjacent to the California Coast outside of enclosed bays, estuaries, and coastal lagoons. Also, the Ocean Plan prescribes effluent quality requirements and management principles for waste discharges and specifies certain waste discharge prohibitions.

The Ocean Plan also provides that the State Board shall designate areas of special biological significance and requires wastes to be discharged at locations which will assure maintenance of natural water quality conditions.

Bays and Estuaries Policy

The "Water Quality Control Policy for the Enclosed Bays and Estuaries of California", adopted by the State Board on May 16, 1974, provides water quality principles and guidelines to prevent water quality degradation and protect the beneficial uses of waters. Decisions by the Regional Board are required to be consistent with the provisions of this policy. This policy does not apply to wastes from vessels or land runoff except as specifically indicated for siltation and combined sewer flows.

WATER QUALITY OBJECTIVES

The water quality objectives which follow supersede and replace those contained in the "Interim Water Quality Control Plan for the Klamath River Basin", the 1967 "Water Quality Control Policy for the Klamath River in California", the 1967 "Water Quality Control Policy for the Smith River in California", the 1967 "Water Quality Control Policy for the Humboldt-Del Norte Coastal Waters", and the 1969 "Water Quality Control Policy for the Lost River in California".

Controllable water quality factors shall conform to the water quality objectives contained herein. When other factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, then controllable factors shall not cause further degradation of water quality.

Controllable water quality factors are those actions, conditions, or circumstances resulting from man's activities that may influence the quality of the waters of the State, and that may be reasonably controlled.

These water quality objectives are considered to be necessary to protect those present and probable future beneficial uses enumerated on Table 2-1 of this plan and to protect existing high quality waters of the State. These objectives will be achieved primarily through the establishment of waste discharge requirements and through the implementation of this water quality control plan.

The Regional Board in setting waste discharge requirements will consider, among other things, the potential impact on beneficial uses within the area of influence of the discharge, the existing quality of receiving waters, and the appropriate water quality objectives. The Regional Board will make a finding as to the beneficial uses to be protected within the area of influence of the discharge and establish waste discharge requirements to protect those uses and to meet water quality objectives.

The water quality objectives for Basin 1-A refer to several classes of waters. Ocean waters are waters of the Pacific Ocean outside of bays and estuaries and within the territorial (3-mile) limit. Bays are indentations along the coast which include oceanic waters within distinct headlands or harbor works whose narrowest opening is less than 75 percent of the greatest dimension of the enclosed portion of the bay; in Basin 1-A, this definition includes only Crescent City Harbor. Estuaries are waters at the mouths of streams which serve as mixing zones for freshwater and seawater; they generally extend from the upstream limit of tidal action to a bay or the open ocean. The principal estuarine areas of Basin 1-A are at the mouths of the Smith and Klamath Rivers and Lakes Earl and Talawa. Inland waters include all surface waters and groundwaters of the basin not included in the definitions of ocean waters, bays, or estuaries. Interstate waters include all rivers, streams, and lakes which flow across or form part of a state boundary. Groundwaters are any subsurface bodies of water which are beneficially used or usable. They

include perched water if such water is used or usable or is hydraulically continuous with used or usable water.

GENERAL OBJECTIVE

The following objective shall apply to all waters of the basin.

Nondegradation

Wherever the existing quality of water is better than the quality objectives established herein, such existing quality shall be maintained unless otherwise provided by the provisions of State Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California", including any revisions thereto. A copy of this policy is included verbatim in the "Plans and Policies Appendix".

OBJECTIVES FOR OCEAN WATERS

The provisions of the State Board's "Water Quality Control Plan for Ocean Waters of California" (Ocean Plan), and "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" (Thermal Plan) and any revisions thereto shall apply. Copies of these plans are included verbatim in the "Plans and Policies Appendix".

OBJECTIVES FOR INLAND SURFACE WATERS, ENCLOSED BAYS, AND ESTUARIES

The following objectives apply to all inland surface waters, enclosed bays, and estuaries of the basin.

Color

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.

Tastes and Odors

Waters shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or adversely affect beneficial uses.

Floating Material

Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

Suspended Material

Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Settleable Material

Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.

Oil and Grease

Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.

Biostimulatory Substances

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.

Sediment

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Turbidity

Turbidity shall not be increased more than 20 percent above naturally occurring background levels. Allowable zones of dilution within which higher percentages can be tolerated may be defined for specific discharges upon the issuance of discharge permits or waiver thereof.

pH

The pH shall conform to those limits listed in Table 4-1. For waters not listed in Table 4-1 and where pH objectives are not prescribed, the pH shall not be depressed below 6.5 nor raised above 8.5.

Changes in normal ambient pH levels shall not exceed 0.2 units in waters with designated marine (MAR) or saline (SAL) beneficial uses nor 0.5 units within the range specified above in fresh waters with designated COLD or WARM beneficial uses.

Dissolved Oxygen

Dissolved oxygen concentrations shall conform to those limits listed in Table 4-1. For waters not listed in Table 4-1 and where dissolved oxygen concentrations shall not be reduced below the following minimum levels at any time:

Waters designated WARM, MAR, or SAL	5.0 mg/l
Waters designated COLD	6.0 mg/l
Waters designated SPWN	7.0 mg/l
Waters designated SPWN during critical spawning and egg incubation periods	9.0 mg/l

Bacteria

The bacteriological quality of waters of the north coastal region shall not be degraded beyond natural background levels. In no case shall coliform concentrations in waters of the north coastal region exceed the following:

In waters designated for contact recreation (REC 1), the median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 ml, nor shall more than 10 percent of total samples during any 30-day period exceed 400/100 ml.

At all areas where shellfish may be harvested for human consumption (SHELL), the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 ml nor shall more than 10 percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used.

Temperature

Temperature objectives for COLD interstate waters, WARM interstate waters, and Enclosed Bays and Estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California", including any revisions thereto. A copy of this plan is included verbatim in the "Plans and Policies Appendix".

In addition, the following temperature objectives apply to surface waters:

- The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses.

- At no time or place shall the temperature of any COLD water be increased by more than 5°F above natural receiving water temperature.

- At no time or place shall the temperature of WARM intrastate waters be increased more than 5°F above natural receiving water temperature.

Toxicity

All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration or other appropriate methods as specified by the Regional Board.

The survival of aquatic life in surface waters subjected to a waste discharge, or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or when necessary for other control water that is consistent with the requirements for "experimental water" as described in "Standard Methods for the Examination of Water and Wastewater", latest edition. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour bioassay.

In additon, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged.

Pesticides

No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no bioaccumulation in pesticide concentrations found in bottom sediments or aquatic life.

Chemical Constituents

Water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in California Administrative Code Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Tables 2, 3. 4, and listed below:

Inorganic Chemicals

Constituent	Limiting Concentration, mg/l
Arsenic	0.10
Barium	1.0
Cadmium	0.01
Chromium	0.05
Cyanide	0.2
Lead	0.05
Mercury	0.005
Nitrate-N + Nitrite-N	10
Selenium	0.01

Fluoride Concentration

Annual Average of Maximum Daily Air Temperature*	Fluoride Concentration, mg/l		
	Lower	Optimum	Upper
50-54	0.9	1.2	1.7
55-58	0.8	1.1	1.5
59-64	0.8	1.0	1.3
65-71	0.7	0.9	1.2
72-79	0.7	0.8	1.0
80-81	0.6	0.7	0.8

*Based on temperature data obtained for a minimum of 5 years

Organic Chemicals

Constituent	Limiting Concentration, mg/l
Carbon-alcohol extract (CAE-m)	3.0
Carbon-chloroform extract (CCE-m)	0.7
Foaming agent (MBAS)	0.5

Waters designated for use as agricultural supply (AGR) shall not contain concentrations of chemical constituents in amounts which adversely affect such beneficial use.

Numerical objectives for individual waters are contained in Table 4-1.

Radioactivity

Radionuclides shall not be present in concentrations which are deleterious to human, plant, animal, or aquatic life nor which result in the accumulation of radionuclides in the food web to an extent which presents a hazard to human, plant, animal, or indigenous aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the limits specified in California Administrative Code Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Table 5, and listed below:

Radioactivity

Gross Beta	1,000 pc/l
Radium-226	3 pc/l
Strontium-90	10 px/l

OBJECTIVES FOR GROUNDWATERS

Tastes and Odors

Groundwaters shall not contain taste- or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

Bacteria

In groundwaters used for domestic or municipal supply (MUN), the concentration of coliform organisms over any 7-day period shall not exceed a median of 2.2/100 ml.

Radioactivity

Groundwaters used for domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the limits specified in California Administrative Code Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Table 5.

Chemical Constituents

Groundwaters used for domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the limits specified in California Administrative Code Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Tables 2, 3, and 4.

Groundwaters used for agricultural supply (AGR) shall not contain concentrations of chemical constituents in amounts that adversely affect such beneficial use.

Numerical objectives for individual groundwaters are contained in Table 4-1.

SPECIFIC OBJECTIVES FOR INLAND SURFACE AND GROUNDWATERS, BAYS, AND ESTUARIES

In addition to the aforementioned objectives, the following specific objectives (Table 4-1) for inland surface and groundwaters, bays, and estuaries shall apply.

As part of the State's continuing planning process, data will be collected and numerical water quality objectives will be developed for those mineral and nutrient constituents where sufficient information is presently not available for the establishment of such objectives.

TABLE 4-1

SPECIFIC OBJECTIVES FOR INLAND SURFACE AND GROUNDWATERS, BAYS, AND ESTUARIES OF BASIN 1-A

Hydrographic Subunit	Specific Conductance (micromhos @ 77° F.) 90th Percentile	Specific Conductance (micromhos @ 77° F.) Med 1/	Dissolved Oxygen (mg/l) Min	Dissolved Oxygen (mg/l) Med	Hydrogen Ion (pH) Max	Hydrogen Ion (pH) Min	Hardness (mg/l) Med	Boron (mg/l) 90th Percentile	Boron (mg/l) Med
Lost River									
Clear Lake Reservoir & Upper Lost River	300	200	5.0	8.0	9.0	7.0	60	0.5	0.1
Lower Lost River	1000	700	5.0	-	9.0	7.0	-	0.5	0.1
Other Streams	250	150	7.0	8.0	8.4	7.0	50	0.2	0.1
Tule Lake	1300	900	5.0	-	9.0	7.0	400	-	-
Lower Klamath Lake	1150	850	5.0	-	9.0	7.0	400	-	-
Groundwaters	1100	500	-	-	8.5	7.0	250	0.3	0.2
Butte Valley									
Streams	150	100	7.0	9.0	8.5	7.0	30	0.1	0.0
Meiss Lake	2000	1300	7.0	8.0	9.0	7.5	100	0.3	0.1
Groundwaters	800	400	-	-	8.5	6.5	120	0.2	0.1
Shasta Valley									
Shasta River	800	600	7.0	9.0	8.5	7.0	220	1.0	0.5
Other Streams	700	400	7.0	9.0	8.5	7.0	200	0.5	0.1
Lake Shastina	300	250	6.0	9.0	8.5	7.0	120	0.4	0.2
Groundwaters	800	500	-	-	8.5	7.0	180	1.0	0.3
Scott Valley									
Scott River	350	250	7.0	9.0	8.5	7.0	100	0.4	0.1
Other Streams	400	275	7.0	9.0	8.5	7.0	120	0.2	0.1
Groundwaters	500	250	-	-	8.0	7.0	120	0.1	0.1
Salmon River									
All Streams	150	125	9.0	10.0	8.5	7.0	60	0.1	0.0
Upper Klamath River									
Klamath River above Iron Gate Dam including Iron Gate & Copco Reservoirs	425	275	7.0	10.0	8.5	7.0	60	0.3	0.2
Klamath River below Iron Gate Dam	350	275	8.0	10.0	8.5	7.0	80	0.5	0.2
Other Streams	300	150	7.0	9.0	8.5	7.0	60	0.1	0.0
Groundwaters	750	600	-	-	8.5	7.5	200	0.3	0.1
Applegate River									
All Streams	250	175	7.0	9.0	8.5	7.0	60	-	-

1/ Median values represent the 50 percentile values of the monthly means for a calendar year.

TABLE 4-1 (Continued)

SPECIFIC OBJECTIVES FOR INLAND SURFACE AND GROUNDWATERS, BAYS, AND ESTUARIES OF BASIN 1-A

Hydrographic Subunit	Specific Conductance (micromhos @ 77° F.) 90th Percentile	Specific Conductance (micromhos @ 77° F.) Med	Dissolved Oxygen (mg/l) Min	Dissolved Oxygen (mg/l) Med	Hydrogen Ion (pH) Max	Hydrogen Ion (pH) Min	Hardness (mg/l) Med	Boron (mg/l) 90th Percentile	Boron (mg/l) Med
Upper Trinity River									
Trinity River	200	175	7.0	10.0	8.5	7.0	80	0.1	0.0
Other Streams	200	150	7.0	10.0	8.5	7.0	60	0.0	0.0
Lake Engle and Lewiston Reservoir	200	150	7.0	10.0	8.5	7.0	60	0.0	0.0
Hayfork Creek									
Hayfork Creek	400	275	7.0	9.0	8.5	7.0	150	0.2	0.1
Other Streams	300	250	7.0	9.0	8.5	7.0	125	0.0	0.0
Ewing Reservoir	250	200	7.0	9.0	8.0	6.5	150	0.1	0.0
Groundwaters	350	225	-	-	8.5	7.0	100	0.2	0.1
S. F. Trinity River									
S. F. Trinity River	275	200	7.0	10.0	8.5	7.0	100	0.2	0.0
Other Streams	250	175	7.0	9.0	8.5	7.0	100	0.0	0.0
Lower Trinity River									
Trinity River	275	200	8.0	10.0	8.5	7.0	100	0.2	0.0
Other Streams	250	200	9.0	10.0	8.5	7.0	100	0.1	0.0
Groundwaters	200	150	-	-	8.5	7.0	75	0.1	0.1
Lower Klamath River									
Klamath River	300*	200*	8.0	10.0	8.5	7.0	75*	0.5*	0.2*
Other Streams	200*	125*	8.0	10.0	8.5	6.5	25*	0.1*	0.0*
Groundwater	300	225	-	-	8.5	6.5	100	0.1	0.0
Illinois River									
All Streams	200	125	8.0	10.0	8.5	7.0	75	0.1	0.0
Winchuck River									
All Streams	200*	125*	8.0	10.0	8.5	7.0	50	0.0	0.0
Smith River									
Smith River-Main Forks	200	125	8.0	11.0	8.5	7.0	60	0.1	0.1
Other Streams	150*	125*	7.0	10.0	8.5	7.0	60	0.1	0.0
Smith River Plain									
Smith River	200*	150*	8.0	11.0	8.5	7.0	60*	0.1*	0.0*
Other Streams	150*	125*	7.0	10.0	8.5	6.5	60*	0.1*	0.0*
Lakes Earl & Talawa	-	-	7.0	9.0	8.5	6.5	-	-	-
Groundwaters	350	100	-	-	8.5	6.5	75	1.0	0.0
Crescent City Harbor	-	-							

*Does not apply to estuarine areas.

NORTH COASTAL BASIN - 1B

The Village of Bodega — Redwood Empire Assn.

Russian River Mouth, Jenner — Corps of Engineers

water habitat to sustain aquatic resources associated with a cold water environment.

Preservation of Areas of Special Biological Significance (BIOL) — Includes marine life refuges, ecological reserves and designated areas of special biological significance, such as areas where kelp propagation and maintenance are features of the marine environment requiring special protection.

Wildlife Habitat (WILD) — Provides a water supply and vegetative habitat for the maintenance of wildlife.

Preservation of Rare and Endangered Species (RARE) — Provides an aquatic habitat necessary, at least in part, for the survival of certain species established as being rare and endangered species.

Marine Habitat (MAR) — Provides for the preservation of the marine ecosystem including the propagation and sustenance of fish, shellfish, marine mammals, waterfowl and vegetation such as kelp.

Fish Migration (MIGR) — Provides a migration route and temporary aquatic environment for anadromous or other fish species.

Fish Spawning (SPWN) — Provides a high quality aquatic habitat especially suitable for fish spawning.

Shellfish Harvesting (SHELL) — The collection of shellfish such as clams, oysters, abalone, shrimp, crab and lobster for either commercial or sport purposes.

The list of beneficial uses in Table 6 reflects future demands on the water resources of the Basin; water quality objectives based on those uses will adequately protect the quality of the Basin's waters for future generations.

WATER QUALITY OBJECTIVES

Section 13241, Division 7 of the California Water Code specifies that each Regional Water Quality Control Board shall establish water quality objectives which, in the Regional Board's judgment, are necessary for the reasonable protection of the beneficial uses and for the prevention of nuisance.

Section 303 of the 1972 Amendments to the Federal Water Pollution Control Act requires the State to submit to the Administrator of the U.S. Environmental Protection Agency for his approval, all new or revised water quality standards which are established for surface and ocean waters. Under federal terminology, water quality standards consist of the beneficial uses enumerated on Table 6 and the water quality objectives contained in this abstract. The water quality objectives contained herein are designed to satisfy all state and federal requirements.

Table 6. Present and Potential Beneficial Uses of Waters of the North Coastal Basin

Unit	MUN[1]	AGR[1]	IND[1]	PROC[1]	GWR	NAV	POW	REC1	REC2	COMM	WARM	COLD	BIOL	WILD	RARE	MAR	MIGR	SPWN	SHELL
Redwood Creek	X[2]	X	X					X	X			X		X	X		X	X	
Mad River	X	X	X	X	X		X[2]	X	X		X	X		X	X		X	X	
Eureka Plain (Humboldt Bay)		X	X			X		X	X	X		X		X	X	X	X	X	X
Eel River	X	X	X		X	X	X	X	X		X	X		X	X		X	X	
Van Duzen River	X	X	X					X	X			X		X	X		X	X	
South Fork Eel River		X	X		X			X	X			X		X	X		X	X	
Middle Fork Eel River	X	X	X		X			X	X			X		X	X		X	X	
Outlet Creek	X[2]	X	X		X			X	X			X		X			X	X	
Bear River	X[2]		X					X	X			X		X			X	X	
Mattole River	X	X	X					X	X			X		X			X	X	
Ten Mile River	X	X	X		X	X		X	X			X		X			X	X	
Noyo River	X		X		X	X		X	X			X		X			X	X	
Jug Handle Creek-Albion River	X[2]		X		X			X	X			X		X			X	X	
Big River	X[2]	X	X		X			X	X			X		X			X	X	
Navarro River	X[2]	X	X		X	X		X	X			X		X			X	X	
Garcia River	X[2]	X	X					X	X			X		X			X	X	
Gualala River	X		X					X	X			X		X			X	X	
Russian River	X	X	X	X	X	X	X[2]	X	X		X	X		X			X	X	
Laguna de Santa Rosa		X	X					X	X			X		X					
Bodega Bay		X	X			X		X	X	X		X	X	X		X	X	X	X
Coastal Waters			X			X		X	X	X			X			X	X	X	X
Minor Coastal Streams Not listed above	X[2]	X[2]	X[2]		X[2]			X[2]	X[2]			X[2]		X[2]			X[2]	X[2]	
Groundwaters	X	X	X	X															

[1]Groundwater or surface water.

[2]Potential.

Beneficial uses for MUN, AGR, or IND water supply may be met by either surface water or groundwater supplies in the designated subbasin. Wells currently provide water for domestic purposes, stock watering and irrigation in many of the subbasins.

As new information becomes available, the Regional Board will review the appropriateness of the objectives contained herein. These objectives will be subject to public hearing at least once during each three-year period following adoption of this plan for the purpose of review and modification as appropriate.

Existing Statewide Plans and Policies

The State Water Resources Control Board has adopted a "Statement of Policy with Respect to Maintaining High Quality of Waters in California", the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California", the "Water Quality Control Plan for Ocean Waters of California", and the "Water Quality Control Policy for the Enclosed Bays and Estuaries of California". The Regional Board is required to implement the provisions of these plans and policies.

Nondegradation Policy

On October 28, 1968, the State Water Resources Control Board adopted Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California". While requiring the continued maintenance of existing high quality waters, the policy provides conditions under which a change in water quality is allowable. A change must:

- be consistent with maximum benefit to the people of the State.
- not unreasonably affect present and

Harbor nr. Fort Bragg, Mendocino County

Dept. of Water Resources

anticipated beneficial uses of water, and

- not result in water quality less than that prescribed in water quality control plans or policies.

Thermal Plan

The "Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California", adopted by the State Water Resources Control Board on May 18, 1972, specifies water quality objectives, effluent quality limits, and discharge prohibitions related to thermal characteristics of interstate waters and waste discharges.

Ocean Plan

The "Water Quality Control Plan for Ocean Waters of California" was adopted by the State Water Resources Control Board on July 6, 1972. This plan establishes beneficial uses and water quality objectives for waters of the Pacific Ocean adjacent to the California Coast outside of enclosed bays, estuaries, and coastal lagoons. Also, the Ocean Plan prescribes effluent quality requirements and management principles for waste discharges and specifies certain waste discharge prohibitions.

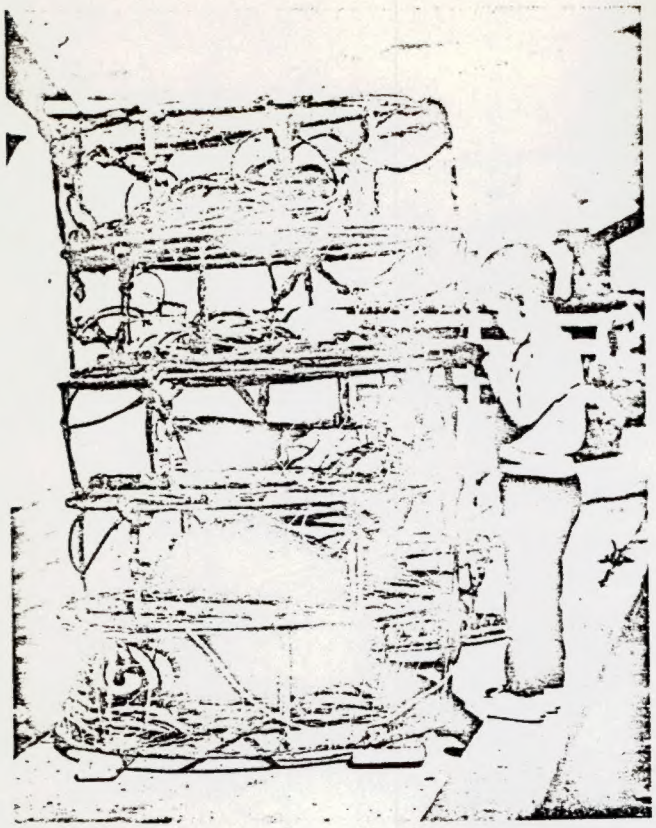
The Ocean Plan also provides that the State Water Resources Control Board shall designate Areas of Special Biological Significance and requires wastes to be discharged at locations which will assure maintenance of natural water quality conditions.

Bays and Estuaries Policy

The "Water Quality Control Policy for the Enclosed Bays and Estuaries of California" adopted by the State Water Resources Control Board on May 16, 1974, provides water quality principles and guidelines for the prevention of water quality degradation and to protect the beneficial uses of waters. Decisions by the Regional Board are required to be consistent with the provisions of this policy. This policy does not apply to wastes from vessels or land runoff except as specifically indicated for siltation and combined sewer flows.

Water Quality Objectives for Surface Waters

The water quality objectives which follow super-



Crab Pots **Redwood Empire Assn.**

sede and replace those contained in the Interim Water Quality Control Plan for the North Coastal Basin, the 1967 Water Quality Control Policy for the Sonoma-Mendocino Coast, and the 1967 Water Quality Control Policy for the Humboldt-Del Norte Coastal Waters.

Controllable water quality factors shall conform to the water quality objectives contained herein. When other factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, then controllable factors shall not cause further degradation of water quality.

Controllable water quality factors are those actions, conditions, or circumstances resulting from man's activities that may influence the quality of the waters of the State, and that may be reasonably controlled.

These water quality objectives are considered to be necessary to protect those present and probable future beneficial uses enumerated on Table 6 and to protect existing high quality waters of the State. These objectives will be achieved primarily through the establishment of waste discharge requirements and through the implementation of this water quality control plan.

The Regional Board in setting waste discharge requirements will consider, among other things, the potential impact on beneficial uses within the area of influence of the discharge, the existing quality of receiving waters, and the appropriate water quality objectives. The Regional Board will make a finding as to the beneficial uses to be protected within the area of influence of the discharge and establish waste discharge requirements to protect those uses and to meet water quality objectives.

The Water quality objectives for Basin 1-B refer to several classes of waters. **Ocean waters** are waters of the Pacific Ocean outside of bays and estuaries and within the territorial (3 mile) limit. **Bays** are indentations along the coast which include oceanic waters within distinct headlands or harbor works whose narrowest opening is less than 75 percent of the greatest dimension of the enclosed portion of the bay. **Estuaries** are waters at the mouths of streams which serve as mixing zones for freshwater and seawater; they generally extend from the upstream limit of tidal action to a bay or the open ocean. **Inland waters** include all surface waters and groundwaters of the basin not included in the definitions of ocean waters, bays, or estuaries. **Interstate waters** include all rivers, streams, and lakes which flow across or form part of a state boundary. **Groundwaters** are any subsurface bodies of water which are beneficially used or usable. They include perched water if such water is used or usable or is hydraulically continuous with used or usable water.

General Objective

The following objective shall apply to all waters of the Basin.

Wherever the existing quality of water is better than the quality objectives established herein, such existing quality shall be maintained unless otherwise provided by the provisions of the State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California", including any revisions thereto. A copy

North Coast Farm, nr. Ferndale, Humboldt County

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of this policy is included verbatim in the "Plans and Policies Appendix." This objective shall apply to all waters within the Basin.

Objectives for Ocean Waters

The provisions of the State Board's "Water Quality Control Plan for Ocean Waters of California" (Ocean Plan), and "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" (Thermal Plan) and any revisions thereto shall apply. Copies of these plans are included verbatim in the "Plans and Policies Appendix" of the full Plan.

Objectives for Inland Surface Waters, Enclosed Bays and Estuaries

The following objectives apply to all inland surface waters, enclosed bays and estuaries of the Basin.

Color

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.

Tastes and Odors

Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance or adversely affect beneficial uses.

Floating Material

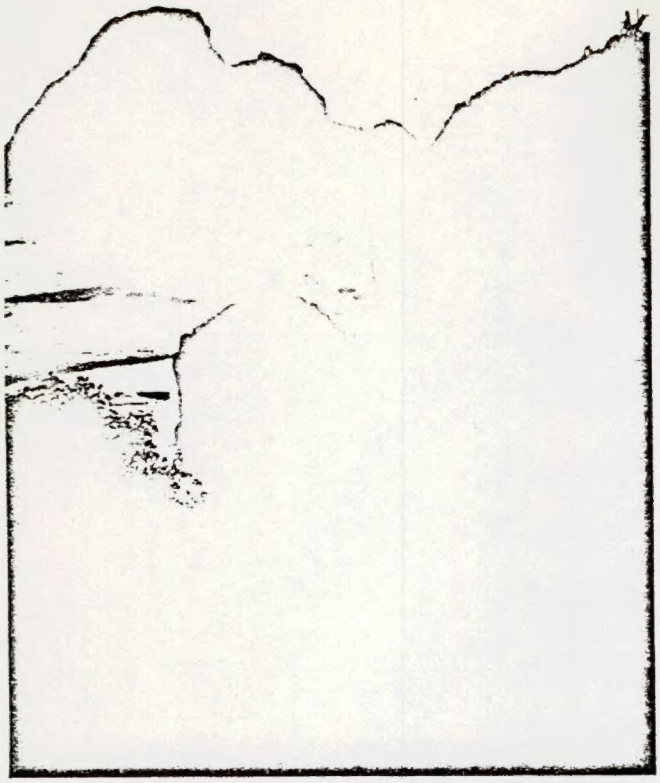
Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

Suspended Material

Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Settleable Material

Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.



Beach nr. Elk Ansel Adams for Redwood Empire Assn.

Oil and Grease

Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.

Biostimulatory Substances

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.

Sediment

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Turbidity

Turbidity shall not be increased more than 20 percent above naturally occurring background levels. Allowable zones of dilution within which higher percentages can be tolerated may be defined for specific discharges upon the issuance of discharge permits or waiver thereof.

pH

The pH shall conform to those limits listed in Table 7 For waters not listed in Table 7 and where pH objectives are not prescribed, the pH shall not be depressed below 6.5 nor raised above 8.5.

Changes in normal ambient pH levels shall not exceed 0.2 units in waters with designated marine (MAR) or saline (SAL) beneficial uses nor 0.5 units within the range specified above in fresh waters with designated COLD or WARM beneficial uses.

Dissolved Oxygen

Dissolved oxygen concentrations shall conform to those limits listed in Table 7 . For waters not listed in Table 7 and where dissolved oxygen objectives are not prescribed the dissolved oxygen concentrations shall not be reduced below the following minimum levels at any time.

Waters designated WARM, MAR, or SAL 5.0 mg/l
Waters designated COLD . . . . . 6.0 mg/l
Waters designated SPWN . . . . . 7.0 mg/l
Waters designated SPWN during critical spawning and egg incubation periods . . . . . 9.0 mg/l

Bacteria

The bacteriological quality of waters of the North Coast Region shall not be degraded beyond natural background levels. In no case shall coliform concentrations in waters of the North Coast Region exceed the following:

In waters designated for contact recreation (Rec 1), the median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 ml, nor shall more than ten percent of total samples during any 30-day period exceed 400/100 ml.

At all areas where shellfish may be harvested for human consumption (SHELL), the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 ml nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used.

Temperature

Temperature objectives for COLD interstate waters, WARM interstate waters, and Enclosed Bays and Estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California" including any revisions thereto. A copy of this plan is included verbatim in the "Plans and Policies Appendix" of the full Plan.

In addition, the following temperature objectives apply to surface waters:

The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses.

At no time or place shall the temperature of any COLD water be increased by more than 5°F above natural receiving water temperature.

At no time or place shall the temperature of WARM intrastate waters be increased more than 5°F above natural receiving water temperature.

Toxicity

All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration or other appropriate methods as specified by the Regional Board.

The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or when necessary for other control water that is consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater, latest edition. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour bioassay.

In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged.

Pesticides

No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no bioaccumulation in pesticide concentrations found in bottom sediments or aquatic life.

see correction sheet

Chemical Constituents

Water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in California Administrative Code, Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Tables 2, 3, and 4

Waters designated for use as agricultural supply (AGR) shall not contain concentrations of chemical constituents in amounts which adversely affect such beneficial use.

Numerical objectives for individual waters are contained in Table 7 .

Radioactivity

Radionuclides shall not be present in concentrations which are deleterious to human, plant, animal or aquatic life nor which result in the accumulation of radionuclides in the food web to an extent which presents a hazard to human, plant, animal or indigenous aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the limits specified in California Administrative Code, Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Table 5, and listed below:

Radioactivity

Gross Beta	1,000 pc/l
Radium-226	3 pg/l
Strontium-90	10 pc/l

Table 7. Specific Water Quality Objectives for North Coastal Basin

Unit	Specific Conductance (micromhos)		Total Dissolved Solids (mg/l)		Dissolved Oxygen (mg/l)			pH	
	90% Values	Med	90% Values	Med	Min	90% Values	Med	Min	Max
Redwood Creek	220	125	115	75	7.0	7.5	10.0	6.5	8.5
Mad River	300	150	160	90	7.0	7.5	10.0	6.5	8.5
Eureka Plain (Humboldt Bay)	---	---	---	---	6.0	6.2	7.0	[1]	8.5
Eel River	375	225	275	140	7.0	7.5	10.0	6.5	8.5
Van Duzen River	375	175	200	100	7.0	7.5	10.0	6.5	8.5
South Fork Eel River	350	200	200	120	7.0	7.5	10.0	6.5	8.5
Middle Fork Eel River	450	200	230	130	7.0	7.5	10.0	6.5	8.5
Outlet Creek	400	200	230	125	7.0	7.5	10.0	6.5	8.5
Bear River	390	255	240	150	7.0	7.5	10.0	6.5	8.5
Mattole River	300	170	170	105	7.0	7.5	10.0	6.5	8.5
Ten Mile River	---	---	---	---	7.0	7.5	10.0	6.5	8.5
Noyo River	185	150	120	105	7.0	7.5	10.0	6.5	8.5
Jug Handle Creek and Albion River	---	---	---	---	7.0	7.5	10.0	6.5	8.5
Big River	300	195	190	130	7.0	7.5	10.0	6.5	8.5
Navarro River	285	250	170	150	7.0	7.5	10.0	6.5	8.5
Garcia River	---	---	---	---	7.0	7.5	10.0	6.5	8.5
Gualala River	---	---	---	---	7.0	7.5	10.0	6.5	8.5
Russian River (upstream)[2]	320	250	170	150	7.0	7.5	10.0	6.5	8.5
Russian River (downstream)[3]	375	285	200	170	7.0	7.5	10.0	6.5	8.5
Laguna de Santa Rosa	---	---	---	---	7.0	7.5	10.0	6.5	8.5
Bodega Bay	---	---	---	---	6.0	6.2	7.0	[1]	8.5
Coastal Waters[4]	---	---	---	---	[5]		[5]	[6]	[6]

[1] pH shall not be depressed below natural background levels.

[2] Russian River (upstream) refers to the mainstem river upstream of its confluence with Laguna de Santa Rosa.

[3] Russian River (downstream) refers to the mainstem river downstream of its confluence with Laguna de Santa Rosa

[4] The State's Ocean Plan applies to all North Coastal Basin coastal waters.

[5] Dissolved oxygen concentrations shall not at any time be depressed more than 10 percent from that which occurs naturally.

[6] pH shall not be changed at any time more than 0.2 units from that which occurs naturally.

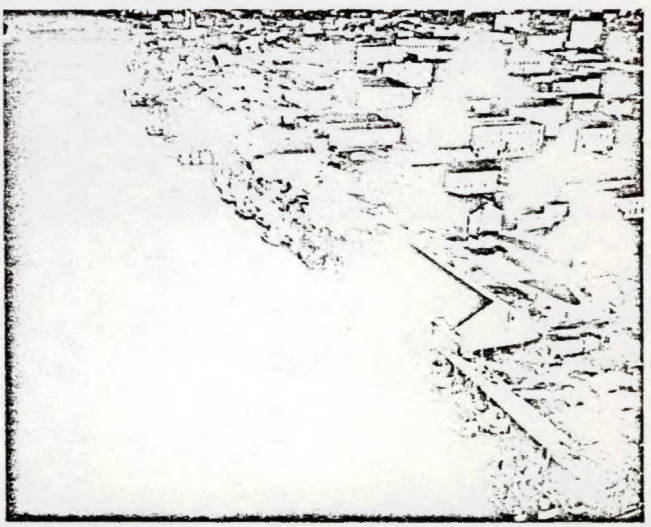
[7] Median values are the 50 percentile values of the monthly means for a calendar year.

Table 8. Inorganic, Organic and Fluoride Concentrations not to be Exceeded in Domestic or Municipal Supply

Constituent	Limiting Concentration		
	Lower	Optimum	Upper
Fluoride*			
50-54	0.9	1.2	1.7
55-58	0.8	1.1	1.5
59-64	0.8	1.0	1.3
65-71	0.7	0.9	1.2
72-79	0.7	0.8	1.0
80-81	0.6	0.7	0.8
Inorganic Chemicals			
Arsenic			0.10
Barium			1.0
Cadmium			0.01
Chromium			0.05
Cyanide			0.2
Lead			0.05
Mercury			0.005
Nitrate-N + Nitrate-N			10
Selenium			0.01
Organic Chemicals			
Carbon-alcohol extract (CAE-m)			3.0
Carbon-Chloroform extract (CCE-m)			0.7
Foaming agent (MBAS)			0.5

*Annual Average of Maximum Daily Air Temperature, °F Based on temperature data obtained for a minimum of five years.

Lower Reaches of Mad River — Corps of Engineers



Fishing Fleet at Eureka — Corps of Engineers

SACRAMENTO RIVER BASIN - 5A

Chapter 4

WATER QUALITY OBJECTIVES

STATE AND FEDERAL REQUIREMENTS

Section 13241, Division 7 of the California Water Code specifies that each Regional Water Quality Control Board shall establish water quality objectives which, in the Regional Board's judgment, are necessary for the reasonable protection of beneficial uses and for the prevention of nuisance.

Section 303 of the 1972 Amendments to the Federal Water Pollution Control Act requires the state to submit to the Administrator of the U.S. Environmental Protection Agency for his approval, all new or revised water quality standards which are established for surface and ocean waters. Under federal terminology, water quality standards consist of the beneficial uses enumerated in Chapter 2 and the water quality objectives contained in this chapter.

The water quality objectives contained herein are designed to satisfy all state and federal requirements.

As new information becomes available, the Regional Board will review the appropriateness of the objectives contained herein. Following adoption of this plan, these objectives will be subject to public hearing at least once during each three-year period for the purpose of review and modification as appropriate.

Considerations in Selecting Water Quality Objectives

This section sets forth the rules used in the development of water quality objectives. Two general rules were followed:

- Previously adopted objectives were retained unless superseded by more recently adopted objectives or contradicted by conclusive technical information.

This rule recognizes the time and effort expended in the development and adoption of objectives. Typically, intensive review by technically competent state and local agencies is an integral part of the adoption procedure. Often, technical or economic compromises were a necessary part of the development of objectives. These aspects of the adoption procedure should not be underestimated and, in fact, should only be abandoned in favor of conclusive technical information.

- Certain critical objectives have considerable effect on the development or operation of the state's water resources system or on the economy of particular segments of the state. Such objectives should not be established without careful consideration of these effects.

This rule implies that at least some water quality objectives should be an output of the planning procedure rather than

a planning constraint adopted early in the planning process.

These two rules lead to a ranking of information used in the development of water quality objectives. Listed below in descending order of priority are the primary sources of such information and their specific use in the development of objectives.

The Thermal Plan. Water quality objectives pertinent to the thermal characteristics of interstate waters are set in this policy (see "Special Appendix, Plans and Policies").

Bays and Estuaries Policy. This policy sets water quality objectives for the estuarian waters of the Sacramento-San Joaquin Delta (see "Special Appendix, Plans and Policies"). Exceptions to this policy are considered only if the exception is more stringent than objectives set in the policy.

Nondegradation Resolution. Present quality is the basis for implementation of the State Board's "Nondegradation Policy" (State Board Resolution No. 68-16, see "Special Appendix, Plans and Policies".) There were three exceptions to the use of present quality as stipulated in this policy:

- Where there was insufficient information to define present quality (with due consideration for random and hydrologic variations). In that case other — possibly less stringent — objectives were used pending the collection and analysis of data necessary to establish present quality.

- Where present quality was poorer than that required to protect all beneficial uses.

- Where conditions exist under which changes in water quality are allowable by the policy itself.

State Board Decisions 1400 and 1422. These are referred to as the American River Decision and the New Melones Decision, respectively. Both of these decisions are now the subject of litigation. Those objectives in the decisions which were compatible with objectives determined by independent technical review were incorporated.

The Interim Basin Plans (IBP) for Basins 5A-5B and 5C-5D. There were two exceptions to the use of IBP objectives:

- Where IBP objectives were restated in more specific terms.

- Where technical information clearly indicated that IBP objectives should be changed to protect or enhance beneficial uses, or where all three exceptions set forth in the "Nondegradation Resolution" were effective.

The Interstate Objectives for the Delta and Goose Lake. The two exceptions are the same as those stated above for the Interim Basin Plan.

Water Quality Literature

Criteria for the various beneficial uses of water were derived from current literature on the subject. The primary literature referenced was Water Quality Criteria, McKee and Wolf[1] and the NTAC Report.[2] A list of criteria by beneficial use was prepared, and these criteria were reviewed and modified by the appropriate state agencies. These criteria represent an up-to-date, comprehensive set of guidelines for the development of water quality objectives.

These guidelines were used in conjunction with additional technical information to revise existing descriptive objectives or develop new objectives. For those waters where specific technical information was not available or which were not covered by existing policies, resolutions or agreements, these criteria served as a guide in setting objectives.

State Board Resolution 67-36. This resolution, known as the Five Freedoms, specifies certain descriptive objectives that can and shall be applicable to all waters at all times.

Other Information. Additional information pertaining to water quality objectives was provided by other agencies and groups in the form of either specific task reports or testimony given at meetings and workshops. This supplemental information was incorporated where appropriate.

EXISTING STATEWIDE PLANS AND POLICIES

The State Board has adopted a "Statement of Policy with Respect to Maintaining High Quality of Waters in California (Nondegradation Policy)," the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California," the "Water Quality Control Plan for Ocean Waters of California," and the "Water Quality Control Policy for the Enclosed Bays and Estuaries of California." The Regional Board is required to implement the provisions of these plans and policies.

Nondegradation Policy

On 28 October 1968 the State Board adopted Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California." While requiring the continued maintenance of existing high-quality waters, the policy provides conditions under which a change in water quality is allowable. A change must:

- Be consistent with maximum benefit to the people of the state
- Not unreasonably affect present and anticipated beneficial uses of water
- Not result in water quality less than that prescribed in water quality control plans or policies

Thermal Plan

The "Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California," adopted by the State Water Resources Control Board on 18 May 1972, specifies water quality objectives, effluent quality limits, and discharge prohibitions related to thermal characteristics of interstate waters and waste discharges.

Bays and Estuaries Policy

The "Water Quality Control Policy for the Enclosed Bays and Estuaries of California" adopted by the State Board on 16 May 1974, provides water quality principles and guidelines for the prevention of water quality degradation in enclosed bays and estuaries and to protect the beneficial uses of such waters. Decisions by the Regional Board are required to be consistent with the provisions of this policy. This policy does not apply to wastes from boats or land runoff except as specifically indicated for siltation and combined sewer flows.

WATER QUALITY OBJECTIVES

The following water quality objectives supersede and replace those contained in Interim Water Quality Control Plans for Basins 5A, 5B, and 5C, and Interstate Standards for the Sacramento-San Joaquin Delta and Goose Lake. Controllable water quality factors shall conform to the water quality objectives contained herein.

When other factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, then controllable factors shall not cause further degradation of water quality. Controllable water quality factors are those actions, conditions, or circumstances resulting from man's activities that may influence the quality of the waters of the state, that are subject to the authority of the State Board, or the Regional Board, and that may be reasonably controlled.

In some instances water quality objectives were formulated to preserve historic conditions, but the data base is not sufficiently complete to determine the temporal and hydrologic variability that is an inherent aspect of historic water quality. When violations of such objectives occur, the Regional Board will use judgment to determine if the objectives could reasonably be achieved through the coordinated control of all factors affecting water quality in the area.

These water quality objectives are considered to be necessary to protect those present and probable future beneficial uses enumerated in Chapter 2 of this plan and to protect existing high quality waters of the state. These objectives will be achieved primarily through the establishment of waste discharge requirements and through the implementation of this water quality control plan and ongoing planning modifications thereof.

The Regional Board, in setting waste discharge requirements will consider, among other things, the potential impact on beneficial uses within the area of influence of the discharge, the existing quality of receiving waters, and the appropriate water quality objectives. The Regional Board will make a finding as to the beneficial uses to be protected within the area of influence of the discharge, and establish waste discharge requirements to protect those uses and to meet water quality objectives.

The objectives are intended to govern the levels of constituents and characteristics in the main water mass unless otherwise designated, and therefore do not apply at or in the immediate vicinity of effluent discharges. Where appropriate, zones of dilution or criteria for diffusion or dispersion will be defined in waste discharge requirements.

General Objectives for all Surface Waters and Estuaries

Water quality objectives contained in the following policies shall apply to all surface waters and estuaries in the basins:

Resolution No. 68-16 – Statement of Policy with Respect to Maintaining High Quality of Waters in California. Wherever the existing quality of water is better than the quality of water established herein as objectives, such existing quality shall be maintained unless otherwise provided by the provisions of the State Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California" (Nondegradation Policy), including any revisions thereto. A copy of this policy is included verbatim in the "Special Appendix, Plans and Policies."

Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California. The provisions of the State Board's "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" (Thermal Plan) and any revisions thereto shall apply. Copies of these plans are included verbatim in the "Special Appendix, Plans and Policies."

Bays and Estuaries Policy. The provisions of this plan and any revisions thereto shall apply. Copies of this plan are included verbatim in the "Special Appendix, Plans and Policies." The water quality objectives for inland surface waters, the Delta, and groundwaters are presented in Tables 4-1, 4-2, and 4-3, respectively.

OBJECTIVES FOR INLAND SURFACE WATERS
TABLE 4-1

This table includes water quality objectives that apply to all inland surface waters (excluding the Delta) of the basins, and objectives that apply only to specific surface water bodies. The identification of water bodies follows the numbering system shown in Figure 2-1. As part of the state's continuous planning process, data will be collected and more specific water quality objectives will be developed for those mineral and nutrient constituents where sufficient information is presently not available for the establishment of specific objectives.

Objectives for the waters of the Sacramento-San Joaquin Delta are presented in Table 4-2, Delta Water Quality Objectives

Bacteria

In waters designated for contact recreation (REC-1), the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed a geometric mean of 200/100 ml, nor shall more than ten percent of the total number of samples taken during any 30-day period exceed 400/100 ml.

The following objective applies to the water body specified:

The fecal coliform concentration based on a minimum of not less than five samples for any 30-day period, shall not exceed a geometric mean of 100/100 ml, nor shall more than ten percent of the total number of samples taken during any 30-day period exceed 200/300 ml.	**Applicable Water Body** Folsom Lake (50)

Biostimulatory Substances

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.

In most water bodies, water quality objectives for nitrogen will not be established until studies to determine the specific effects of nitrogen on algal growth in the Delta, the lower San Joaquin River, and San Francisco Bay are completed.

At the present time, only limited productive areas within the Delta (e.g., Sherman Island and Franks Tract) show any significant levels of sensitivity to nitrogen. Elsewhere in the Delta, indications are that algal levels would not

be influenced by limiting nitrogen because light penetration (a function of turbidity) may be the limiting factor. Until the relationships between nutrients from controllable and uncontrollable sources and algal levels have been established, it is not productive to set specific numerical water quality objectives for nitrogen in the basin waters. Wherever possible, facility plans should maintain flexibility to allow for future nitrogen removal processes.

Chemical Constituents

Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. Water designated for use as domestic or municipal supply (MUNI) shall not contain concentrations of chemical constituents in excess of the limits specified in California Administrative Code, Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Tables 2, 3, and 4. The limits described therein will be reviewed on a case-by-case basis in order to assure protection of beneficial uses other than MUN, as appropriate. To the extent of any conflict with the above, the more stringent objective applies.

In addition to the limits referred to previously, the limits for inorganic chemicals listed in Table 4-1.1 shall apply to the water bodies indicated.

INORGANIC CHEMICAL LIMITS
TABLE 4-1.1

Constituent	Maximum Concentration mg/l	Applicable Water Body
Arsenic	0.01	
Barium	0.1	
Copper	0.01	
Cyanide	0.01	Sacramento River, Keswick Dam to Eye Street Bridge (13,30)
Iron	0.3	American River, Folsom Dam to Sacramento River (51)
Manganese	0.05	Folsom Lake (50), Sacramento-San Joaquin Delta (Δ)
Silver	0.01	
Zinc	0.1	

The following objectives for electrical conductivity and total dissolved solids apply to the water bodies specified. To the extent of any conflict with the above, the more stringent shall apply.

(1) The 25°C Electrical Conductivity:	Applicable Water Body
• Shall not exceed 230 micromhos/cm (50 percentile) or 235 micromhos/cm (90 percentile) at Knights Landing above Colusa Basin Drain; or 240 micromhos/cm (50 percentile) or 340 micromhos/cm (90 percentile) at Freeport, based upon previous moving 10 years of record.	Sacramento River, Shasta Dam to Colusa Basin Drain (13) Sacramento River, Colusa Basin Drain to Eye Street Bridge (30)

	Applicable Water Body
• Shall not exceed 150 micromhos/cm (90 percentile) in well-mixed waters of the Feather River.	North Fork, Feather River (33) Middle Fork, Feather River, Little Last Chance Creek to Lake Oroville (36) Feather River, Fish Barrier Dam to Sacramento River (40)
• Shall not be greater than 150 micromhos/cm from Friant Dam to Gravelly Ford (90 percentile).	San Joaquin River, Friant Dam to Mendota Pool (69)
(2) Total Dissolved Solids:	
• Shall not exceed 1,300,000 tons	Goose Lake (2)
• Shall not exceed 125 mg/l (90 percentile)	North Fork, American River, Source to Folsom Lake (44) Middle Fork, American River, Source to Folsom Lake (45) South Fork, American River, Source to Folsom Lake (48,49) American River, Folsom Dam to Sacramento River (51)
• Shall not exceed 100 mg/l (90 percentile)	Folsom Lake (50)

Color

Water shall be free of discoloration that causes nuisance or adversely affects beneficial uses.

Dissolved Oxygen

The monthly median of the mean daily dissolved oxygen concentration shall not fall below 85 percent of saturation in the main water mass and the 95 percentile concentration shall not fall below 75 percent of saturation. The dissolved oxygen concentrations shall not be reduced below the following minimum levels at any time:

• Waters designated WARM	5.0 mg/l
• Waters designated COLD	7.0 mg/l
• Waters designated SPWN	7.0 mg/l

The following objectives apply to the water bodies specified. To the extent of any conflict with the above, the more stringent objective applies. The dissolved oxygen concentrations:

	Applicable Water Body
(1) Shall be maintained at or near established seasonal levels from Keswick Dam to Eye Street Bridge	Sacramento River, Shasta Dam to Eye Street Bridge (13,30)

		Applicable Water Body
(2)	Shall be greater than or equal to 9.0 mg/l from Keswick Dam to Hamilton City from 1 June to 31 August. When natural conditions lower the dissolved oxygen below this level, the concentration shall be maintained at or above 95 percent of saturation.	Sacramento River, Shasta Dam to Colusa Basin Drain (13)
(3)	Shall be greater than or equal to 7.0 mg/l from Hamilton City to Eye Street Bridge from 1 June to 31 August.	Sacramento River, Shasta Dam to Eye Street Bridge (13, 40)
(4)	Shall be greater than or equal to 7.0 mg/l all year.	Lake Natoma
(5)	Shall be greater than or equal to 8.0 mg/l from Oroville Fish Barrier Dam to Honcut Creek from 1 September to 31 May.	Feather River, Fish Barrier Dam to Sacramento River (40)
(6)	Shall be greater than or equal to 8.0 mg/l from Cressey to New Exchequer Dam at all times.	Merced River, Source to McClure Lake (78)
(7)	Shall be greater than or equal to 8.0 mg/l from Waterford to La Grange from 15 October to 15 June.	Tuolumne River, Don Pedro Dam to San Joaquin River (86)

Floating Material

Water shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses.

Oil and Grease

Waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.

pH

The pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses.

The following objective applies to the water body specified:	Applicable Water Body
pH shall be less than 9.5 and greater than 7.5 at all times.	Goose Lake (2)

Pesticides

No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life that adversely affects beneficial uses. Pesticides are defined as any substance or mixture of substances used to control objectionable insects, weeds, rodents, fungi, or other forms of plant or animal life.

Total identifiable chlorinated hydrocarbon pesticides shall not be present at concentrations detectable within the accuracy of analytical methods prescribed in Standard Methods for the Examination of Water and Wastewater, latest edition, or other equivalent methods approved by the Executive Officer.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the limiting concentrations set forth in California Administrative Code, Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Table 4.

The following objectives apply to the water bodies specified. To the extent of any conflict with the above, the more stringent objective applies.

	Applicable Water Body
The sum of the individual concentrations of pesticides shall not exceed 0.1 µg/1.	Folsom Lake (50) American River, Folsom Dam to Sacramento River (51)

Radioactivity

Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal or aquatic life nor that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal or aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the limits specified in California Administrative Code, Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Table 5.

Sediment

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Settleable Material

Waters shall not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.

Suspended Material

Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Tastes and Odors

Waters shall not contain taste- or odor-producing substances in concentrations that impart undesireable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin – that cause nuisance, or otherwise adversely affect beneficial uses.

Temperature

The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses.

Temperature objectives for COLD interstate waters, WARM interstate waters, and Enclosed Bays and Estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California" including any revisions thereto. A copy of this plan is included verbatim in the "Special Appendix, Plans and Policies."

At no time or place shall the temperature of any COLD intrastate water be increased more than 5°F above natural receiving water temperature.

At no time or place shall the temperature of WARM intrastate waters be increased more than 5°F above natural receiving water temperature.

The following objectives apply to the water bodies specified. To the extent of any conflict with the above, the more stringent objective applies.

	Applicable Water Body
(1) Temperature changes due to controllable factors shall be limited as follows: • From 1 December to 15 March, the maximum temperature shall be 55°F. • From 16 March to 15 April, the maximum temperature shall be 60°F. • From 16 April to 15 May, the maximum temperature shall be 65°F. • From 16 May to 15 October, the maximum temperature shall be 70°F. • From 16 October to 15 November, the maximum temperature shall be 65°F. • From 16 November to 30 November, the maximum temperature shall be 60°F.	Sacramento River, Source to Box Canyon Reservoir (9) Sacramento River, Box Canyon Dam to Shasta Lake (11)
(2) The temperature in the epilimnion shall be less than or equal to 75°F or mean daily ambient air temperature, whichever is greater.	Lake Siskiyou (10)
(3) The temperature shall not be elevated above 56°F in the reach from Keswick Dam to Hamilton City nor above 68°F in the reach from Hamilton City to the Eye Street Bridge during periods when temperature increases will be detrimental to the fishery.	Sacramento River, Shasta Dam to Colusa Basin Drain (13) Sacramento River, Colusa Basin Drain to Eye Street Bridge (30)

Toxicity

All waters shall be maintained free of toxic substances in concentrations that are toxic to or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration or other appropriate methods as specified by the Regional Board.

OBJECTIVES FOR INLAND SURFACE WATERS
TABLE 4-1 (Continued)

The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or, when necessary, for other control water that is consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater, latest edition. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour bioassay.

In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate; additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available; and source control of toxic substances will be encouraged.

Turbidity

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.

Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:

- Where natural turbidity is between 0 and 50 Jackson Turbidity Units (JTU), increases shall not exceed 20 percent.
- Where natural turbidity is between 50 and 100 JTU, increases shall not exceed 10 JTU.
- Where natural turbidity is greater than 100 JTU, increases shall not exceed 10 percent.

Exceptions to the above limits will be considered when a dredging operation can cause an increase in turbidity. In this case, an allowable zone of dilution within which turbidity in excess of limits can be tolerated will be defined for the operation and prescribed in a discharge permit.

The following objective applies to the water body specified. To the extent of any conflict with the above, the more stringent objective applies:

		Applicable Water Body
(1)	Except for periods of storm runoff, the turbidity shall be less than or equal to 10 JTU.	Folsom Lake (50) American River, Folsom Dam to Sacramento River (51)

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ponds or reservoirs where botulism has caused problems. Recommendations have been made by NTAC for the water quality of wildlife habitats.

PRESERVATION OF RARE AND ENDANGERED SPECIES (RARE)

Water quality criteria to be achieved to encourage development and protection of rare or endangered species should be the same as those for protection of fish and wildlife habitats generally. However, where rare or endangered species exist, special control requirements may be necessary to assure attainment and maintenance of particular quality criteria, which may vary slightly with the environmental needs of each particular species.

FRESHWATER REPLENISHMENT (FRSH)

Water quality levels are important here only as they pertain to replenishing freshwater for inland lakes and streams of varying salinities. For the most part, it applies to groundwater pumped for other beneficial uses which, when released from those uses, provides replenishment water. It also applies to reclaimed water used for makeup water in irrigation reservoirs.

EXISTING STATEWIDE PLANS AND POLICIES

The State Water Resources Control Board has adopted a "Statement of Policy with Respect to Maintaining High Quality of Waters in California" and the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California".

Nondegradation Policy

On October 28, 1968, the State Water Resources Control Board adopted Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California". A copy of this policy is included in the "Special Appendix Plans and Policies." While requiring the continued maintenance of existing high quality waters, the policy provides conditions under which a change in water quality is allowable. A change must:

- be consistent with maximum benefit to the people of the State,
- not unreasonably affect present and anticipated beneficial uses of water, and
- not result in water quality less than that prescribed in water quality control plans or policies.

Thermal Plan

The "Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California", adopted by the State Water Resources Control Board on May 18, 1972, specifies water quality objectives, effluent quality limits, and discharge prohibitions related to thermal characteristics of interstate waters and waste discharges.

WATER QUALITY OBJECTIVES

The water quality objectives which follow supersede and replace those contained in the Interim Water Quality Control Plan (1971) and where necessary the water quality control policies for the Truckee River (1967), Lake Tahoe (1966) (the addendum to the Lake Tahoe Policy regarding Control of Siltation (1970)), East and West Forks of the Carson River (1967), Bryant Creek (1970), East Walker River (1967) and West Walker River and Topaz Lake (1967).

Controllable water quality factors shall conform to the water quality objectives contained herein. When other factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, then controllable factors shall not cause any further degradation of water quality.

Controllable water quality factors are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the State and that may be reasonably controlled.

These water quality objectives are considered to be necessary to protect those present and probable future beneficial uses enumerated in Chapter 2 of this plan and to protect existing high quality waters of the State. These objectives will be achieved primarily through the establishment of waste discharge requirements and through the implementation of this water quality control plan.

The Regional Board in setting waste discharge requirements will consider, among other things, the potential impact on beneficial uses within the area of influence of the discharge, the existing quality of receiving waters, and the appropriate water quality objectives. The Regional Board will make a finding as to the beneficial uses to be protected within the area of influence of the discharge and establish waste discharge requirements to protect those uses and to meet water quality objectives.

General Objectives

Wherever the existing quality of water is better than the quality of water established herein as objectives, such existing quality shall be maintained unless otherwise provided by the provisions of the State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California", including any revisions thereto. A copy of this policy is included verbatim in the Special Appendix, "Plans and Policies."

Objectives For Surface Waters

In addition to the objective of nondegradation, the following water quality objectives apply to all surface waters of the Basin. These objectives represent maximum acceptable levels of water quality that shall be maintained in the event that exceptions are made with respect to nondegradation in accordance with the provisions of the State's Nondegradation Policy.

Color

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses. (This objective is believed to be equivalent to the State of Nevada standard of a maximum 10 Platinum Cobalt Unit Change).

Tastes and Odors

Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance or adversely affect beneficial uses.

Floating Material

Waters shall not contain floating material, including solids, liquids, foams and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

Suspended Material

Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Settleable Material

Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.

Oil and Grease

Waters shall not contain oils, greases, waxes or other materials in concentrations that result in a

visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect benefical uses.

Biostimulatory Substances

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Numerical objectives for nutrients are specified in Table 4-1.

Sediment

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Turbidity

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity shall not exceed natural levels by more than 10 percent.

Additional turbidity objectives for specific surface waters are contained in Table 4-1.

pH

The pH shall not be depressed below 6.5 nor raised above 8.5, except in Eagle Lake where the pH shall not be depressed below 8.0 nor raised above 9.5 and in Lake Tahoe where the pH shall not be depressed below 7.0 nor raised above 8.4.

Changes in normal ambient pH levels shall not exceed 0.5 units in fresh waters with designated COLD or WARM beneficial uses.

Dissolved Oxygen

The dissolved oxygen concentration, in terms of percent saturation, shall not be depressed by more than 10 percent, nor shall the minimum, dissolved oxygen concentration at any time be less than 80 percent of saturation or less than the following limits, whichever is more restrictive:

Waters designated WARM.....5.0 mg/l
Waters designated COLD.....7.0 mg/l

Bacteria

Waters shall not contain concentrations of coliform organisms attributable to human wastes. Also, in waters designated for contact recreation (REC-1), the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200/100 ml, nor shall more than 10 percent of total samples during any 30-day period exceed 400/100 ml, with the following exceptions:

Eagle Lake
Susan River
Lake Tahoe
Truckee River
East Fork Carson River
West Fork Carson River
East Walker River
West Walker River
Lake Topaz
Bryant Creek

The fecal coliform concentration for these waters and their tributaries, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 20/100 ml, nor shall more than 10 percent of total samples during any 30-day period exceed 40/100 ml.

In waters designated for noncontact recreation (REC-2) and not designated for contact recreation (REC-1), the average fecal coliform concentration for any 30-day period, shall not exceed 2000/100 ml nor shall more than 10 percent of samples collected during any 30-day period exceed 4000/100 ml.

Temperature

Temperature objectives for COLD interstate waters are as specified in the "Water Quality Control Plan for Control of Temperature in The Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" including any revisions thereto. A copy of this plan is included verbatim in the "Special Appendix, Plans and Policies".

In addition, the following temperature objectives apply to surface waters:

The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not create a nuisance or adversely affect beneficial uses.

At no time or place shall the temperature of any WARM water be increased by more than 5°F above natural receiving water temperature. Temperature of COLD water shall not be raised above natural levels.

Toxicity

All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration or other appropriate methods as specified by the Regional Board.

The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or when necessary, for other control water that is consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater, latest edition. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour bioassay.

In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged.

The discharge of wastes shall not cause concentrations of un-ionized ammonia (NH_3) to exceed 0.025 mg/l (as N) in receiving waters.

Pesticides

The summation of concentrations of total identifiable chlorinated hydrocarbons, organophosphates, carbonates, and all other pesticide and herbicide groups, in all waters of the basin, shall not exceed the lowest detectable levels, using the most recent detection procedures available. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the limiting concentrations set forth in California Administrative Code, Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019,.Table 4.

Chemical Constituents

Water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in California Administrative Code Title 17, Chapter 5, Subchapter

1, Group 1, Article 4, Section 7019, Tables 2, 3, and 4.

Waters designated for use as agricultural supply (AGR) shall not contain concentrations of chemical constituents in amounts that adversely affect such beneficial use.

Numerical objectives for individual waters are contained in Table 4-1.

Radioactivity

Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal, or aquatic life nor that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life.

Waters shall not contain concentrations of radionuclides in excess of the limits specified in California Administrative Code, Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Table 5.

Water Quality Objectives for Specific Surface Waters

Numerical water quality objectives for specific surface waters of the Basin are presented in Table 4-1.

As part of the State's continuing planning process, data will be collected and numerical water quality objectives will be developed for those constituents in Table 4-1 where sufficient information is presently not available for the establishment of such objectives.

Objectives for Groundwater

In addition to the objective of nondegradation, the following water quality objectives apply to all groundwaters of the Basin. These objectives represent maximum acceptable levels of water quality that shall be maintained in the event that exceptions are made with respect to nondegradation in accordance with the provisions of the State's Nondegradation Policy.

Tastes and Odors

Groundwaters shall not contain taste or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

Bacteria

In groundwaters used for domestic or municipal supply (MUN) the median concentration of coliform organisms over any seven-day period shall be less than 2.2/100 ml.

Chemical Constituents

Groundwaters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in California Administrative Code Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Tables 2, 3, and 4.

Groundwaters designated for use as agricultural supply (AGR) shall not contain concentrations of chemical constituents in amounts that adversely affect such beneficial use.

Radioactivity

Groundwaters shall not contain concentrations of radionuclides in excess of the limits specified in California Administrative Code, Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Table 5.

Objectives For Specific Groundwaters

Specific mineral objectives for groundwater basins are not included at this time due to the wide range of values experienced in each basin. Considerable data is available for establishing existing quality levels in specific parts of a basin as a

result of concentrated usage of groundwater in these areas. However, data on vertical and horizontal variations in water quality within the basins are not presently developed, and it is not possible at this time to establish meaningful mineral objectives for these waters.

As part of the State's continuing planning process, appropriate data will be collected and numerical water quality objectives developed for mineral constituents in groundwaters where sufficient information is presently not available.

TABLE 4-1
CHEMICAL WATER QUALITY OBJECTIVES FOR SURFACE WATERS
OF THE NORTH LAHONTAN BASIN

Constituent* (mg/l except as noted)

Surface Water	TFR**	Cl	SO_4	% Na	B	Total N	Total P
Surprise Valley Hydrologic Unit							
Bidwell Creek	55 / -	1.0 / -	- / -	- / -	0.05 / -	0.2 / -	- / -
Mill Creek	70 / -	0.8 / -	- / -	- / -	0.02 / -	0.2 / -	- / -
Cedar Creek	100 / -	1.0 / -	- / -	- / -	0.03 / -	0.2 / -	- / -
Eagle Creek	60 / -	0.5 / -	- / -	- / -	0.02 / -	0.1 / -	- / -
Emerson Creek	90 / -	0.8 / -	- / -	- / -	0.01 / -	0.2 / -	- / -
Bear Creek	110 / -	0.6 / -	- / -	- / -	0.02 / -	0.1 / -	- / -
Eagle Lake Hydrologic Unit							
Eagle Lake	635 / 800	20 / 23	0.9 / 1.8	60 / 62	0.08 / 0.10	1.0 / 1.1	0.04 / 0.06
Pine Creek	60 / -	1.0 / -	2.3 / -	- / -	0.01 / -	0.1 / -	- / -
Merrill Creek	70 / -	1.0 / -	0.5 / -	- / -	0.01 / -	0.1 / -	- / -
Papoose Creek	55 / -	1.0 / -	0.5 / -	- / -	0.01 / -	0.2 / -	- / -
Honey Lake Hydrologic Unit							
Willow Creek @ Merrillville Rd	310 / 335	9.5 / 10.0	0.4 / 0.5	- / -	0.01 / -	0.7 / 0.8	0.10 / 0.11
Willow Creek @ Co. Rd. 216	200 / 230	6.6 / -	- / -	- / -	0.01 / -	0.6 / -	0.05 / -
Willard Creek	40 / 45	1.2 / 1.5	- / -	- / -	0.01 / -	0.01 / -	0.03 / -
Cheney Creek	70 / 75	0.01 / -	- / -	- / -	0.01 / -	0.01 / -	0.03 / -
Susan River above Willard Creek	60 / 75	0.7 / 1.0	1.0 / -	- / -	0.01 / -	0.2 / 0.3	0.06 / 0.40
Susan River @ Susanville	95 / 105	2.0 / 5.0	- / -	15 / 20	0.01 / 0.10	0.65 / 0.80	0.15 / 0.25
Susan River nr Litchfield at U.S. 395	185 / 250	4.2 / 7.5	25 / 40	- / -	0.1 / 0.2	0.65 / 0.80	0.25 / 0.30
Piute Creek	135 / 155	1.0 / 1.2	0.6 / 0.8	- / -	0.01 / -	0.5 / 0.6	0.14 / 0.15

* Annual Average Value / 90th Percentile Value
** Total Filtrable Residue (Total Dissolved Solids)

TABLE 4-1 (cont'd)
CHEMICAL WATER QUALITY OBJECTIVES FOR SURFACE WATERS
OF THE NORTH LAHONTAN BASIN

Constituent* (mg/l except as noted)

Surface Water	TFR	Cl	SO_4	% Na	B	Total N	Total P
Gold Run Creek	40/50	0.2/-	-/-	-/-	0.01/-	0.1/-	0.02/-
Lassen Creek	65/80	0.01/-	-/-	-/-	0.01/-	0.4/-	0.2/-
Baxter Creek	70/75	0.4/-	-/-	-/-	0.01/-	0.5/-	0.12/-
Truckee River Hydrologic Unit							
Truckee River at Farad	65/75	4.0/8.0	3.2/5.0	25/30	0.05/0.15	0.40/0.80	0.02/0.06
Truckee River at Truckee	65/75	4.0/8.0	-/-	25/30	-/-	0.40/0.80	0.015/0.04
Martis Creek	65/75	5.0/10.0	1.5/2.5	25/30	-/0.1	0.20/-	0.010/0.020
Donner Creek	50/65	4.0/8.0	-/-	-/-	-/0.1	0.20/-	0.010/0.020
Squaw Creek	90/120	3.0/5.1	-/-	-/-	-/-	0.20/-	0.010/0.020
Bear Creek	65/80	1.0/1.3	1.6/2.5	-/-	-/-	0.20/-	0.010/0.020
Lake Tahoe Hydrologic Unit							
Lake Tahoe[a/]	60/65	3/4	1.0/2.0	-/-	0.01/-	0.15/0.25	0.008/0.020
Fallen Leaf Lake	50/-	0.30/0.50	1.3/1.4	-/-	0.01/0.02	0.20/-	0.005/0.01
Griff Creek	80/-	0.40/-	-/-	-/-	-/-	0.24/-	0.020/-
Carnelian Bay Cr.	80/-	0.40/-	-/-	-/-	-/-	0.21/-	0.010/-
Watson Creek	80/-	0.35/-	-/-	-/-	-/-	0.21/-	0.010/0.020
Dollar Creek	80/-	0.30/-	-/-	-/-	-/-	0.16/-	0.010/-
Burton Creek	90/-	0.30/-	-/-	-/-	-/-	0.10/0.15	0.008/0.014
Ward Creek	70/85	0.30/0.50	1.4/2.8	-/-	-/-	0.25/0.35	0.020/0.030
Blackwood Creek	70/90	0.30/-	-/-	-/-	-/-	0.20/-	0.020/0.030

*Annual Average Value/90th Percentile Value

APPENDIX H

NEVADA

WATER POLLUTION CONTROL

REGULATIONS

NEVADA WATER POLLUTION CONTROL REGULATIONS

(Adopted by State Commission of Environmental Protection November 14, 1972; Effective December 16, 1972; Amended October 24, 1973; May 13, 1974)

ARTICLE 1: DEFINITIONS

In addition to the definitions set forth in NRS Chapter 445 which are hereby incorporated for the purposes of interpreting this regulation, the following words and phrases shall have the meaning ascribed to them herein.

1.1 Administrator – The U.S. Environmental Protection Agency's administrator of Region IX.

1.2 "Bureau" means the Bureau of Environmental Health of the Health Division of the Department of Health, Welfare and Rehabilitation.

1.3 "Complete treatment" means that degree of treatment which is required to continuously produce a water which meets State Board of Health drinking water standards.

1.4 "Conventional treatment" includes but is not limited to processes such as coagulation, sedimentation, filtration and disinfection; however, it does not include desalting techniques.

1.5 "Critical materials" are materials, except sewage of human origin, on the Register of Critical Materials prepared by the Commission which are or may become deleterious to humans, animals, fish, plants, or other aquatic life.

1.6 "Discharge, spillage or deposit" is the placement of wastes into waters of the State, on land, in the ground, in the air, or into a sewerage system.

1.7 "Discharge standard" is the specifications for discharging or depositing wastes and shall be included in the waste discharge permit.

1.8 "Disinfection" is the destruction or inactivation of disease-producing organisms.

1.9 "Filtration" is a physical-chemical process for removing suspended and colloidal impurities from water by passage through a porous medium by the following mechanisms: absorption, flocculation, sedimentation, and straining.

1.10 "Individual sewage disposal system" means a system of sewage treatment tanks or tank and effluent absorption or percolation facilities serving a single dwelling or structure.

1.11 "Industrial wastes" are wastes resulting from any process of industry, manufacturing, trade or business, or from the development or recovery of any natural resource.

1.12 "Natural waters" means waters which have not been degraded or enhanced by actions attributable to man.

1.13 "Origin" means all waters tributary to those waters being classified and are considered a part of the waters being classified unless otherwise designated.

1.14 "Sewage" is the water-carried human or animal waste from residences, buildings, industrial establishments, feedlots, or other places, together with such ground water infiltration and surface water as may be present. The mixture of sewerage with wastes and/or industrial wastes shall also be considered sewage within the meaning of these regulations.

1.15 "Treatment or waste treatment" is the stabilization or alteration of the quality of waste waters by physical, biological, or chemical means, or a combination thereof, for the purpose of reducing or eliminating adverse effects on water quality, such that the tendency of said wastes to cause any degradation in water quality or other environmental conditions is reduced or eliminated.

1.16 "Waste discharge permit or permit" is a written document issued by the Department, which under certain specified conditions established by the Department authorizes the person, firm, partnership, corporation, municipal corporation, association or governmental entity to whom it is issued to construct, install, modify, or operate specified activities, or discharge wastes to the waters of the State in accordance with specified limitations established by the Department.

1.17 "Wastes" shall include sewage, critical materials, industrial wastes, and all other liquid, gaseous, or solid radioactive or non-radioactive substances which adversely affect the temperature or quality of any waters of the state.

ARTICLE 2: [Reserved]

ARTICLE 3: ADMINISTRATION OF WASTE DISCHARGE PERMITS

3.1 Permit Required.

3.1.1 Any person, firm, industrial corporation or governmental entity who discharges or deposits wastes into public waters of the state is, in the absence of an appropriate Department Waste Discharge Permit, in violation of these rules and regulations. The filing of an application requesting a waste discharge permit does not preclude any legal action provided by law to prevent or abate violations.

3.1.2 No person, firm, industrial corporation, municipal corporation or governmental entity without first obtaining a permit from the Department shall:

a. Construct, install, expand, or significantly modify any factory, mill, plant or other industrial or commercial facility which will result in a waste discharge not authorized by an existing permit to waters of the State.

b. Add extensions to existing municipal or privately owned sewer systems or provide new sewer service to existing or newly constructed buildings which could cause the raw sewage influent to the treatment plant to exceed the limits prescribed by the permit.

c. Construct, install, or significantly modify any facilities designed or used for treatment or discharge of waste.

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d. Operate any facilities which function to treat or dispose of wastes.

e. Discharge any wastes into any waters of the State.

f. Conduct any industrial, commercial, or agricultural operation which will or may cause or tend to cause pollution of any waters of the State.

g. Construct or use any new outlet for discharge of wastes into waters of the State.

3.1.3 In establishing a discharge standard, consideration shall be given to, but shall not be limited by the following, to the end that the policy of the state as declared in Section 3(2) in A.B. 472 shall be effectively carried out:

a. The effect of the discharge on the receiving water and its beneficial use.

b. The need for standards that specify by chemical, physical, biological or other characteristics the extent to which pollution by various substances will not be tolerated.

c. Requirements for establishing water quality standards promulgated from time to time by the Federal Environmental Protection Agency.

3.1.4 The cost of all testing and sampling as may be required and specified in writing by the Department shall be provided and paid for by the discharger.

3.1.5 Although not exempted from complying with all other applicable laws, rules, and regulations regarding pollution, the following are specifically exempted from the above requirements to obtain a permit:

a. Persons utilizing individual sewage disposal systems for sewage and commercial or industrial wastes, other than critical materials, providing such system is approved and is installed, operated, and maintained in accordance with the rules and regulations and other requirements of the district health departments or the State Board of Health. This exemption does not preclude the possibility that health authorities will require permits.

b. Persons discharging wastes other than critical materials into a publicly owned or privately owned sewerage system providing the owner of such sewerage system has a valid permit from the Department. In such cases, the owner of such sewerage system assumes ultimate responsibility for controlling and treating the wastes which he allows to be discharged into said system.

c. Agricultural irrigation return waters.

3.2 Type, Duration, and Termination of Permits.

3.2.1 Permits issued by the Department shall specify those activities and discharges which are permitted as well as the requirements, limitations, conditions, and schedules which must be met.

3.2.2 The duration of permits may be variable, but shall not exceed five (5) years. The expiration date shall be recorded on each permit issued. A new application must be filed with the Department to obtain renewal or modification of a permit. Applications for renewal shall be filed at least 180 days prior to expiration of a permit.

3.2.3 Permits are issued to the official applicant of record for the activities or discharges of record, and shall expire upon:

a. The expiration date of the permit.

b. Issuance of a new or modified permit for the same operation.

c. Written request for the permittee.

3.3 General Conditions and Rules.

3.3.1 In the event the permittee is temporarily unable to comply with any of the conditions of the permit, due to breakdown of equipment or other cause, the permittee shall immediately notify the Department of the breakdown or cause, and the steps taken to correct the problem and prevent its recurrence. A written report shall be submitted within five (5) working days following the incident.

3.3.2 Authorized representatives of the Bureau of Environmental Health shall be permitted access to the premises of all facilities owned or operated by the permittee at all reasonable times for the purpose of making inspections, surveys, collecting samples, obtaining data, and carrying out other necessary functions related to the permit.

3.3.3 Whenever a significant change is anticipated in the quantity or character of the waste to be discharged such that the conditions of the permit are violated or the limitations will be exceeded, a new application shall be submitted, together with the necessary reports, plans and specifications for the proposed changes. No change shall be made until plans are approved and a new permit issued.

3.3.4 The permit is subject to revocation if it is determined:

a. that the permit was procured by misrepresentation or lack of full disclosure of any material fact in the application;

b. that there has been a violation of any of the conditions contained therein; or

c. that there has been a material change in the quantity or character of waste or method of waste disposal.

3.4 Application for Permit.

3.4.1 Any person required to obtain a new, modified or renewal permit from the Department shall submit a written application on a form provided by the Bureau of Environmental Health. All application forms must be completed in full, signed by the applicant or his legally authorized representative, and accompanied by three copies of all required exhibits. The name of the applicant must be the legal name of the owner of the facilities or his agent or the lessee responsible for the operation and maintenance of the facilities. An application submitted by a corporation must be signed by the principal executive officer of that corporation, or by an official with the rank of corporate vice president or above, who reports directly to such principal executive officer and who has been designated by the principal executive officer to make such applications on behalf of the corporation. In the case of a partnership or a sole proprietorship, the application must be signed by a general partner or by the proprietor. In the case of a municipal, State, or other public facility the application must be signed by either a principal executive officer, ranking elected official, or other duly authorized employee. Each application must contain a certification by the person signing the application that he is familiar with the information provided, that to the best of his knowledge and belief such information is complete and accurate, and that he has the

authority to sign and execute the application. An application is not deemed to be complete until any additional information requested by the Department is submitted by the applicant.

3.4.2 Each application for a permit filed with the Department will be reviewed on its own merits. Conditions and limitations of the permit will be developed in accordance with the provisions of all applicable laws, rules and regulations of the State of Nevada and the Commission relating to water quality control with consideration of other sources of wastes in the area adjacent to the proposed point of discharge. At least 60 days must be allowed for complete review and processing of any application.

3.4.3 In the event that an application has not been processed by the Department within 60 days after a completed application has been filed, the applicant shall be deemed to have received a temporary permit, such permit to expire upon final action by the Department to grant or deny a permit requested in the original application. Such temporary permit does not authorize any activity or discharge which will violate any existing laws, rules, or regulations of the State of Nevada or the Commission.

3.4.4 If, upon review of an application, the Department determines that a permit is not required, the Department shall notify the applicant in writing of this determination. Such notification shall constitute final action by the Department on the application.

3.5 Hearings, Permits, Notifications.

3.5.1 Upon receipt of an application for a permit, the Department shall immediately notify the Administrator of such application. Whenever such a discharge may affect the quality of the waters of any other state, the Department, within 30 days of the date of notice of the application for such permit, shall so notify such other state and the applicant. If within 60 days after receipt of such notification, such other state determines that the discharge will affect the quality of its waters so as to violate any water quality requirement in such state and within such 60 day period notifies the Department and the Administrator in writing of its objection to the issuance of such permit and request a public hearing on such objection. The Department shall hold such a hearing to be conducted according to the provisions of Chapter 233B of NRS. The Administrator shall at such hearing submit his evaluation and recommendations with respect to any such objection to the Department. The Department, based upon the recommendations of such state, the Administrator and upon any additional evidence, if any, presented to the Department at the hearing, shall condition such permit in such manner as may be necessary to insure compliance with applicable water quality requirements. If the imposition of conditions cannot insure such compliance, the Department shall not issue such permit.

3.5.2 A public hearing may be held on any application prior to issuance of a permit. The Department shall notify the applicant of its intent to schedule such a hearing and the procedures to be followed.

3.5.3 If a permit is issued, the applicant shall be notified in writing of the specific limitations and conditions contained in the permit. A copy of the permit issued shall be attached to the notification.

3.5.4 If the Department determines that a permit should not be issued, the applicant shall be notified of the denial and the reasons for the denial by certified mail.

3.5.5 A copy of each permit application and each permit issued shall be available to the public.

3.6 Modification, Suspension or Revocation of Permit.

3.6.1 In the event it becomes necessary for the Department to institute modification proceedings of a permit due to changing conditions or standards, receipt of additional information, or any other reason, the Department shall notify the permittee by certified mail of its intent to modify the permit and the time and place of proceedings. Such action to modify shall include the proposed modification and the reasons for such modifications and the permittee shall be deemed a necessary party in such proceedings.

3.6.2 In the event it becomes necessary for the Department to suspend or revoke a permit as the result of noncompliance with the terms of the permit, unapproved change in operation, the submission of false information in the application, or for any other cause, the Department shall notify the permittee by certified mail of suspension or revocation of the permit.

3.7 Special Permits.

3.7.1 The Department may waive the procedures prescribed in Article 3.6.1 and issue special permits of duration to be set by the Department for unexpected emergency activities or discharges which are essential to the protection of property and preservation of public health and welfare. Written application for such permits will fully describe the emergency and the proposed activities or discharges.

3.8 Appeal and Judicial Review.

3.8.1 If the applicant or permit holder is dissatisfied with the issuance, denial, renewal, suspension or revocation of a permit; or the issuance, modification or rescission or any other order by the Department he may appeal to the Commission. Such appeal to the Commission shall be made in writing to the Commission within 10 days of the date of notification. Any hearing shall be conducted pursuant to the regulations of the Commission.

3.8.2 Any decision or order of the Commission may be appealed as provided in Section 45 of Assembly Bill 472. Any such appeal shall be commenced in the proper court within 30 days after the date that the Commission renders a decision in any contested case or matter, and notice thereof is given to the Commission as provided in Article 3.8.2.1.

3.8.2.1 No such appeal shall be heard unless notice thereof shall have been served upon the Commission, personally or by registered mail, within 30 days after the date the Commission renders a decision on the matter in question.

3.9 *Emergency Powers*

In accordance with the powers granted in subsections 1, 9 and 12 of NRS 445.214 and NRS 445.317, 445.321, 445.324, 445.327, 445.331, 445.334 and 33.010, the Director may take any appropriate action authorized under the Nevada Water Pollution Control Law against a

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pollution source or any combination of sources which the Director has evidence is presenting an imminent and substantial endangerment to the health or welfare of persons, where such endangerment is to the livelihood of such persons.

ARTICLE 4: WATER QUALITY STANDARDS

4.1 The quality of any waters receiving waste discharges shall be such that no impairment of the beneficial usage of water shall occur as the result of such discharge. Natural water conditions may on occasion be outside of the limits established by standards. The standards adopted herein relate to the condition of waters as affected by discharges relating to the activities of man.

4.1.1 Water Quality Criteria Related to Beneficial Uses.

a. Agricultural use. Water shall be suitable for stock watering and irrigation without treatment.

b. Aquatic life. The water shall be suitable as a habitat for fish or other aquatic life indigenous to a body of water.

c. Bathing and water contact sports. There shall be no evidence of man-made pollution, floating debris, sludge accumulation or similar pollutants.

d. Boating and esthetics. The water shall be free from visible floating, suspended or settled solids arising from man's activities, sludge banks; slime infestation; heavy growth of attached plants, blooms or high concentrations of plankton, discoloration or excessive acidity or alkalinity that leads to corrosion of boats and docks; surfactants that foam when the water is agitated or aerated; excessive water temperatures.

The presence of toxic materials in a water shall be evaluated by use of a 96-hour bioassay. Survival of test organisms shall not be less than that in control tests which utilize appropriate control water. Control water shall be obtained from the most upstream control point in the stream system, or laboratory water with quality closely approximating that of the most upstream control point, or other appropriate control water defined by the State and concurred in by EPA. Failure to determine presence of toxic substances by this method shall not preclude determination of excessive levels of toxic substances on the basis of other criteria or methods.

e. Drinking water supply. The water must be capable of being treated by conventional water treatment methods in order to comply with Nevada's drinking water standards.

f. Industrial supply. The water must be treatable to provide a quality of water which is suitable for the intended use.

g. Wildlife propagation. Shall be suitable for the propagation of wildlife and waterfowl without treatment.

4.1.2 Narrative Standards Applicable to All Waters of the State.

.a. Free from substances attributable to domestic or industrial waste or other controllable sources that will settle to form sludge or bottom deposits in amounts sufficient to be unsightly, putrescent or odorous, or in amounts sufficient to interfere with any beneficial use of the water.

b. Free from floating debris, oil, grease, scum, and other floating materials attributable to domestic or industrial waste or other controllable sources in amounts sufficient to be unsightly or in amounts sufficient to interfere with any beneficial use of the water.

c. Free from materials attributable to domestic or industrial waste or other controllable sources in amounts sufficient to produce taste or odor in the water or detectable off-flavor in the flesh of fish, or in amounts sufficient to change the existing color, turbidity or other conditions in the receiving stream to such degree as to create a public nuisance, or in amounts sufficient to interfere with any beneficial use of the water.

d. Free from high temperature, biocides, organisms pathogenic to human beings, toxic, corrosive, or other deleterious substances attributable to domestic or industrial waste or other controllable sources at levels or combinations sufficient to be toxic to human, animal, plant or aquatic life or in amounts sufficient to interfere with any beneficial use of the water.

e. Radioactive materials attributable to municipal, industrial or other controllable sources shall be the minimum concentrations which are physically and economically feasible to achieve. In no case shall materials exceed the limits established in the 1962 Public Health Service Drinking Water Standards (or later amendments) or 1/30th of the MPCw values given for continuous occupational exposure in the National Bureau of Standards Handbook No. 69. The concentrations in water shall not result in accumulations of radioactivity in plants or animals that result in a hazard to humans or harm to aquatic life.

f. No wastes from municipal or industrial or other controllable sources containing arsenic, barium, boron, cadmium, chromium, cyanide, fluoride, lead, selenium, silver, copper and zinc that are reasonably amenable to treatment or control will be discharged untreated or uncontrolled into the waters of Nevada. In addition, the limits for concentrations of the chemical constituents will provide water quality consistent with the mandatory requirements of the 1962 Public Health Service Drinking Water Standards.

4.2 Classification of Waters.

The following stream standards and classifications do not preclude the Commission from establishing standards and classifications for additional public waters nor reclassifying the waters contained herein. The Commission will consider classification of a public water not contained in these tables upon request for a permit to discharge to such water.

4.2.1 *Class A Waters:* This classification is intended primarily to include waters or portions thereof located in areas of little human habitation; no industrial development or intensive agriculture; and where the watershed is relatively undisturbed by man's activity.

4.2.1.1 *Beneficial uses:* Drinking water supply with treatment by disinfection only suitable for aquatic life habitat, wildlife propagation, agricultural use, recreation, boating and esthetics.

4.4.1.2 *Quality Standards for Class A Waters:*

Items: 1. Floating solids, sludge deposits, tastes or odor producing substances.

Specifications: None attributable to man's activities.

Items: 2. Sewage, industrial wastes or other wastes.
Specifications: None.
Items: 3. Critical materials; oils; deleterious substances; colored or other wastes.
Specifications: None.

Item: 4. Settleable solids.
Specifications: Only amounts attributable to man's activities which will not make the waters unsafe or unsuitable as a drinking water source or which will not be detrimental to aquatic life or for any other beneficial use established for this class.

Item: 5. pH.
Specifications: Range between 6.5 to 8.5.

Item: 6. Dissolved oxygen.
Specifications: Shall not be less than 6.0 milligrams/liter.

Item: 7. Temperature.
Specifications: Shall not exceed 20 degrees C. Allowable temperature increase above natural receiving water temperature – none.

Item: 8. Fecal coliform.
Specifications: The fecal coliform concentration, based on a minimum of 5 samples during any 30-day period shall not exceed a geometric mean of 200 per 100 milliliters, nor shall more than 10% of total samples during any 30-day period exceed 400 per 100 milliliters.

Item: 9. Total phosphate.
Specifications: Total phosphate shall not exceed 0.15 mg/l in any stream at the point where it enters any reservoir or lake, nor 0.075 mg/l in any reservoir or lake, nor 0.30 mg/l in streams and other flowing waters.

Item: 10. Total dissolved solids.
Specifications: Shall not exceed 500 mg/l or one-third above that characteristic of natural conditions (whichever is less).

4.2.1.3 Table A reflects the waters classified as Class A.

TABLE A

Class A Waters

HR - Hydrographic Region
HA - Hydrographic Area

CARSON CITY

Water	HR	HA	Description of Area Classified
Ash Canyon	8	104	From its origin to the first point of diversion of the Carson City Water Department.
Clear Creek	8	104	From its origin to gaging station; number 10-3105 located in NE¼NW¼ Sec. 1, T14N, R19E, MDB&M.
Kings Canyon	8	104	From its origin to the point of the diversion of the Carson City Water Department.

DOUGLAS COUNTY

Daggett Creek	8	105	From its origin to the Carson River
Genoa Creek	8	105	From its origin to the first diversion box at the mouth of the canyon.
Sierra Canyon Creek	8	105	From its origin to the first diversion structure at the mouth of the canyon.

ELKO COUNTY

Angel Lake	10	177	The entire lake.
Bear Creek	3	39	From its origin to the point of diversion for the Jarbidge municipal water supply.
Brown's Gulch	3	37	From its origin to the point of diversion for the Mountain City municipal water supply.
Camp Creek	3	40	From its origin to the National Forest boundary.

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ELKO COUNTY (Continued)

Water	HR	HA	Description of Area Classified
Canyon Creek	3	40	From its origin to the National Forest boundary.
Cottonwood Creek	3	40	From its origin to the Nation l Forest boundary.
Deep Creek	3	37	From its origin to the Wildhorse Reservoir.
Green Mountain Creek	4	47	From its origin to the National Forest boundary.
Hendricks Creek	3	37	From its origin to Wildhorse Reservoir.
Humboldt River (N. Fork) and tributaries in Independence Mountain Range	4	44	From its origin to National Forest boundary.
Humboldt River (S. Fork) and tributaries	4	46	From its origin to Lee.
Jack Creek	3	36	From its origin to the North line of T41N, R52E, MDB&M.
Lamoille Creek	4	45	From its origin to gaging station number 10-316500 located in the NE¼ Section 6, T32N, R58E, MDB&M.
Maggie Creek Tributaries	4	51	From their origin to the point where they become Maggie Creek or the point where they reach Maggie Creek.
Mary's River	4	42	From its origin to the point where the river crosses the East line of T42N, R59E, MDB&M.
Owyhee River (E. Fork) above Wildhorse	3	37	From its origin to Wildhorse Reservoir.
Penrod Creek	3	37	From its origin including tributaries to Wildhorse Reservoir.
Pole Canyon Creek	10	76	From its origin to where it becomes Franklin River.
Secret Creek	4	43	From its origin to National Forest boundary.
Starr Creek	4	43	From its origin to National Forest boundary.
Tabor Creek	4	42	From its origin to the East line of T40N, R60E, MDB&M.
Toyn Creek	4	47	From its origin to National Forest boundary.
Willow Creek	4	63	From its origin to Willow Creek Reservoir.

EUREKA COUNTY

Water	HR	HA	Description of Area Classified
Denay Creek	4	53	From its origin to Tonkin Reservoir.
Roberts Creek	10	139	From its origin to Roberts Creek Reservoir.
Tonkin Reservoir	4	53	The entire reservoir.

HUMBOLDT COUNTY

Bilk Creek	2	29	From its origin to its intersection with the South line of Section 35, T45N, R32E, MDB&M.
Blue Lakes	1	2	Entire area.
Bottle Creek	2	31	From its origin to the first point of diversion.
Dutch John Creek	4	68	The entire length.
Leonard Creek	2	28	From its origin to the first point of diversion.
Little Humboldt River (N. Fork)	4	67	From its origin to National Forest boundary.
Little Humboldt River (S. Fork)	4	67	From its origin to Elko-Humboldt county line.
Mahogany Creek	2	27	From its origin to Summit Lake.
Martin Creek	4	68 69	From its origin to National Forest boundary.
Pole Creek	4	70	From its origin to the point of diversion of the Golconda water supply.
Quinn River	2	28,29 30,33	From its origin to the confluence of the East fork and South fork.
Water Canyon Creek	4	71	From its origin to the point of diversion of the Winnemucca municipal water supply.

LANDER COUNTY

Big Creek	4	56	From its origin to the East boundary of U. S. Forest Service Big Creek Campground.
Birch Creek	10	137	From its origin to the National Forest boundary.
Kingston Creek	10	137	From its origin to Groves Reservoir.
Lewis Creek	4	59	From its origin to the first point of diversion.
Mill Creek	4	59	From its origin to the first point of diversion.

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LANDER COUNTY (Continued)

Water	HR	HA	Description of Area Classified
Rock Creek	4	61,62 63	From its origin to Squaw Valley Ranch.
Skull Creek	10	138	From its origin to the first point of diversion.
Steiner Creek	10	138	From its origin to the first point of diversion.

MINERAL COUNTY

Corey Creek	9	110C	From its origin to the point of diversion of the Town of Hawthorne.
Cottonwood Creek	9	110B	From its origin to the point of diversion of the Hawthorne Naval Ammunition Depot.
Rose Creek	9	110B	From its origin to the point of diversion of the Hawthorne Naval Ammunition Depot.
Squaw Creek	9	110B	From its origin to the point of diversion of the Hawthorne Naval Ammunition Depot.

NYE COUNTY

Barley Creek	10	140	From its origin to the first point of diversion.
Currant Creek	10	173	From its origin to the National Forest boundary.
Jett Creek	10	137	From its origin to the National Forest boundary.
Mosquito Creek	10	140	From its origin to the National Forest boundary.
Peavine Creek	10	137	From its origin to the first point of diversion.
Pine Creek	10	140	From its origin to the National Forest boundary.
Reese Creek	4	56	From its origin to its confluence with Indian Creek.
San Juan Creek	4	56	From its origin to the National Forest boundary.
Stoneberger Creek	10	140	From its origin to the National Forest boundary.
Twin River (N. Fork)	10	137	From its origin to the first point of diversion.
Twin River (S. Fork)	10	137	From its origin to the first point of diversion.

PERSHING COUNTY

Star Creek	10	129	From its origin to the first point of diversion.

WASHOE COUNTY

Boulder Reservoir	1	9	The entire reservoir.
Catnip Reservoir	1	6	The entire reservoir.
Franktown Creek	6	89	From its origin to the first irrigation diversion.
Galena Creek	6	88	From its origin to the east line of section 18, T17N, R19E, MDB&M.
Hunter Creek	6	91	From its origin to Hunter Lake.
Hunter Lake	6	87	The entire lake.
Nigger Creek	2	24	From its origin to the first irrigation diversion.
Ophir Creek	6	89	From its origin to Old US Highway 395.
Price's Lakes	6	89	The entire lakes.
Whites Creek	6	87	From its origin to the east line of section 33, T18N, R19E, MDB&M.

WHITE PINE COUNTY

Baker Creek	11	195	From its origin to the National Forest boundary.
Berry Creek	10	179	From its origin to pipeline intake.
Bird Creek	10	179	From its origin to pipeline intake.
Cave Creek	10	179	Its entire length.
Cleve Creek	10	184	From its origin to the National Forest boundary
Currant Creek	10	173	From its origin to the National Forest boundary.
Duck Creek	10	179	From its origin to pipeline intake.
East Creek	10	179	From its origin to pipeline intake.
Goshute Creek	10	179	From its origin to the first point of diversion.
Hendry's Creek	11	195	From its origin to the National Forest boundary.
Huntington Creek	4	47	From its origin to the White-Pine-Elko county line.
Lehman Creek	11	195	From its origin to the National Forest boundary.
North Creek	10	179	From its origin to pipeline intake.
Pine Creek	10	184	From its origin to the first point of diversion.
Ridge Creek	10	184	From its origin to the first point of diversion.
Silver Creek	11	195	From its origin to the National Forest boundary.
Timber Creek	10	179	From its origin to pipeline intake.
White River	13	207	From its origin to the National Forest boundary.

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4.2.2 *Class B Waters:* This classification includes waters or portions thereof which are located in areas of light or moderate human habitation, little industrial development, light to moderate agricultural development, and where the watershed is only moderately influenced by man's activity.

4.2.2.1 *Beneficial uses:* Drinking water supply with treatment by disinfection and filtration only, for agricultural use, aquatic life and wildlife propagation, recreation, industrial supply and esthetics.

4.2.2.2 *Quality Standards for Class B Waters:*

Items: 1. Floating solids, settleable solids; sludge deposits.

Specifications: Only such amounts attributable to man's activities which will not make the waters unsafe or unsuitable as a drinking water source, injurious to fish or wildlife or impair the waters for any other beneficial use established for this class.

Items: 2. Sewage, industrial wastes or other wastes.

Specifications: None which are not effectively treated to the satisfaction of the Commission.

Item: 3. Odor producing substances.

Specifications: Only such amounts which will not impair the palatability of drinking water or fish or have a deleterious effect upon fish, wildlife or any beneficial uses established for waters of this class.

Items: 4. Critical materials; oils; deleterious substances: colored or other wastes; or heated or cooled liquids.

Specifications: Only such amounts as will not render the receiving waters injurious to fish or wildlife, or impair the receiving waters for any beneficial uses established for this class.

Item: 5. pH.

Specifications: Range between 6.5 to 8.5.

Item: 6. Dissolved oxygen.

Specifications: For trout waters not less than 6.0 milligrams/liter; for nontrout waters not less than 5.0 milligrams/liter.

Item: 7. Temperature.

Specifications: Shall not exceed 20 degrees C for trout waters of 24 degrees C for nontrout waters. Allowable temperature increase above natural receiving water temperatures – none.

Item: 8. Fecal coliform.

Specifications: The coliform concentration, based on a minimum of 5 samples during any 30-day period, shall not exceed a geometric mean of 200 per 100 milliliters, nor shall more than 10% of total samples during any 30-day period exceed 400 per 100 milliliters.

Item: 9. Total phosphates.

Specifications: Total phosphates shall not exceed 0.3 mg/l.

Item: 10. Total dissolved solids.

Specifications: Shall not exceed 500 mg/l or one-third above that characteristic of natural conditions (whichever is less).

4.2.2.3 Table B reflects the waters classified as Class B Waters:

TABLE B

Class B Waters

HR - Hydrographic Region
HA - Hydrographic Area

CARSON CITY

Water	HR	HA	Description of Area Classified
Clear Creek	8	104	From gaging station number 10-3105 located in the NE¼NW¼ Section 1, T14N, R19E, MDB&M to the Carson River.

ELKO COUNTY

Bull Run Reservoir	3	35	The entire reservoir.
Camp Creek	3	40	From the National Forest boundary to its confluence with the South Fork of Salmon Falls Creek.
Canyon Creek	3	40	From the National Forest boundary to its confluence with the South Fork of Salmon Falls Creek.

ELKO COUNTY (Continued)

Water	HR	HA	Description of Area Classified
Cottonwood Creek	3	40	From the National Forest boundary to its confluence with the South Fork of Salmon Falls Creek.
Green Mountain Creek	4	47	From the National Forest boundary to its confluence with Corral Creek.
Humboldt River (N. Fork)	4	44	From the National Forest boundary to its confluence with the Humboldt River.
Humboldt River (S. Fork)	4	46	From Lee to its confluence with the Humboldt River.
Huntington Creek	4	47	From White Pine County line to confluence with South Fork Humboldt River.
Jack Creek	3	36	From the north line of T41N, R52E, to South Fork Owyhee River.
Lamoille Creek	4	45	From gaging station number 10-316500 located in the NE¼ Section 6, T32N, R58E, MDB&M, to its confluence with the Humboldt River.
Maggie Creek	4	51	From where it is formed by tributaries to its confluence with Jacks Creek.
Mary's River	4	42	From the east line of T42N, R59E, MDB&M, to its confluence with the Humboldt River.
Ruby Marsh	10	176	The entire area.
Salmon Falls Creek (N. Fork)	3	40	From the National Forest boundary to its confluence with the South Fork of Salmon Falls Creek.
Salmon Falls Creek (S. Fork)	3	40	From the National Forest boundary to its confluence with the North Fork of Salmon Falls Creek.
76 Creek	3	38	Its entire length.
Secret Creek	4	43	From the National Forest boundary to the Humboldt River.
Starr Creek	4	43	From the National Forest boundary to the Humboldt River.
Wildhorse Reservoir	3	37	The entire reservoir.
Willow Creek Reservoir	4	63	The entire reservoir.
Wilson Reservoir	3	35	The entire reservoir.

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EUREKA COUNTY

Denay Creek	4	53	Below Tonkin Reservoir.
Fish Springs Pond	10	155	The entire pond.
Roberts Creek	10	139	Below Roberts Creek Reservoir.

HUMBOLDT COUNTY

Bilk Creek	2	29	From its intersection with the south line of Section 35, T45N, R32E, MDB&M to Bilk Creek Reservoir.
Bilk Creek Reservoir	2	29	The entire reservoir.
Knott Creek Reservoir	1	3	The entire reservoir.
Little Humboldt River (N. Fork)	4	67	From the National Forest boundary to its confluence with the South Fork of the Little Humboldt River.
Little Humboldt River (S. Fork)	4	67	From the Elko-Humboldt County line to its confluence with the North Fork of the Little Humboldt River.
Martin Creek	4	68,69	From the National Forest boundary downstream to the first diversion in T42N, R40E, MDB&M.
Summit Lake	2	27	The entire lake.
Onion Valley Reservoir	1	2	The entire reservoir.
Quinn River	2	28,29 30,33	From the point of confluence of the East Fork and South Fork to the Ft. McDermitt Indian Reservation diversion dam.

LANDER COUNTY

Big Creek	4	56	From the east boundary of the U. S. Forest Service Big Creek Campground to the first diversion dam.
Birch Creek	10	137	From the National Forest boundary to th. first diversion dam.
Groves Lake	10	137	The entire lake.
Iowa Canyon Reservoir	4	55	The entire reservoir.
Kingston Creek	10	137	Below Groves Lake.
Reese River	4	56,58 59	From its confluence with Indian Creek to Old Hwy US50.

LANDER COUNTY (Continued)

Willow Creek Reservoir	10	131	The entire reservoir.

LINCOLN COUNTY

Clover Creek	13	204	From its origin to the point where it crosses the east range line of T4S, R67E, MDB&M.
Eagle Valley Creek	13	200 201	From its headwaters to Eagle Valley Reservoir.
Eagle Valley Reservoir	13	201	The entire reservoir.

NYE COUNTY

Adams McGill Reservoir	13	207	The entire reservoir.
Currant Creek	10	173	From the National Forest boundary to Currant.
Dacey Reservoir	13	207	The entire reservoir.
Hay Meadow Reservoir	13	207	The entire reservoir.
Reese River	4	56	From its confluence with Indian Creek to Old U.S. Hwy 50.
Sunnyside Creek	13	207	From its origin to the Adams McGill Reservoir.

WASHOE COUNTY

Davis Lake	6	89	The entire lake.
Franktown Creek	6	89	From the first irrigation diversion to Washoe Lake.
Galena Creek	6	88	From the east line of Section 18, T17N, R19E, MDB&M to gaging station number 10-348900 located in the SW¼SW¼ Section 2, T17N, R19E, MDB&M.
Hobart Reservoir and Tributaries	6	89	The entire system.
Hunter Creek	6	91	From Hunter Lake to its confluence with the Truckee River.
Ophir Creek	6	89	From Old U.S. Hwy 395 to Washoe Lake.
Squaw Creek Reservoir	2	21	The entire reservoir.
Wall Canyon Reservoir	1	16	The entire reservoir.
Whites Creek	6	87	Below the east line of Section 33, T18N, R19E, MDB&M.

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WHITE PINE COUNTY

Water	HR	HA	Description of Area Classified
Cave Lake	10	179	The entire lake.
Illipah Reservoir	10	174	The entire reservoir.
Silver Creek Reservoir	11	195	The entire reservoir.
White River	13	207	From the National Forest boundary to its confluence with Ellison Creek.

4.2.3 *Class C Waters:* This classification includes waters or portions thereof which are located in areas of moderate to urban human habitation, industrial developments present in moderate amounts, intensive agricultural practices and the watershed considerably altered by man's activity.

4.2.3.1 *Beneficial uses:* Domestic water supply following complete treatment, agricultural use, aquatic life, wildlife propagation, recreation, and industrial supply.

4.2.3.2 *Quality Standards for Class C Waters:*

Items: 1. Floating solids, settleable solids; sludge deposits.

Specifications: Only such amounts attributable to the activities of man which will not make the receiving waters injurious to fish or wildlife or impair the waters for any beneficial use established for this class.

Items: 2. Sewage, industrial wastes, or other wastes.

Specifications: None which are not effectively treated to the satisfaction of the Commission.

Items: 3. Critical materials; oils; deleterious substances; colored or other wastes; or heated or cooled liquids.

Specifications: Only such amounts as will not render the receiving waters injurious to fish and wildlife or impair the waters for any beneficial use established for this class.

Item: 4. pH.

Specifications: Range between 6.5 to 8.5.

Item: 5. Dissolved oxygen.

Specifications: For trout waters not less than 6.0 mg/l; for nontrout waters not less than 5.0 mg/l.

Item: 6. Temperature.

Specifications: Shall not exceed 20 degrees C for trout waters or 34 degrees C for nontrout waters. Allowable temperature increase above normal receiving water temperature – 3 degrees C.

Item: 7. Fecal coliform.

Specifications: The more stringent of the following apply: The fecal coliform concentration shall not exceed a geometric mean of 1,000 per 100 milliliters nor shall more than 20% of the total sample exceed 2,400 per 100 milliliters. – The annual geometric mean of fecal coliform concentration shall not exceed that characteristic of natural conditions by more than 200 per 100 milliliters nor shall the number of fecal coliform in a single sample exceed that characteristic of natural conditions by more than 400 per 100 milliliters. – The fecal coliform concentration, based on a minimum of 5 samples during any 30-day period, shall not exceed a geometric mean of 200 per 100 milliliters, nor shall more than 10% of total samples during any 30-day period exceed 400 per 100 milliliters. This is applicable only to those waters used for primary contact recreation.

Item: 8. Total phosphates.

Specifications: Total phosphates shall not exceed 1.0 mg/1.

Item: 9. Total dissolved solids.

Specifications: Shall not exceed 500 mg/l or one-third above that characteristic of natural conditions (whichever is less).

4.2.3.3 Table C reflects waters classified as Class C Waters:

TABLE C

Class C Waters

HR - Hydrographic Region
HA - Hydrographic Area

CHURCHILL COUNTY

Water	HR	HA	Description of Area Classified
Diagonal Drain	8	101	Its entire length.
Harmon Reservoir	8	101	The entire reservoir.
Indian Lakes	8	101	All the lakes, including Upper Lake, Likes Lake, Papoose Lake, Big Indian Lake, Little Cottonwood Lake, Big Cottonwood Lake, and East Lake.
Lower Carson River	8	101	From Lahontan Reservoir to Carson Sink (the natural channel).
Rattlesnake Reservoir	8	101	Also known as S-Line Reservoir, the entire reservoir.
South Carson Lake	8	101	Also known as Government Pasture and/or the Greenhead Gun Club, the entire lake.
Stillwater Marsh	8	101	All that area of Stillwater Marsh east of Westside Road and north of the community of Stillwater.
V-Line Canal	8	101	From the Carson diversion dam to its division into the S & L Canals.

CLARK COUNTY

Bowman Reservoir	13	220	The entire reservoir.
Muddy (Moapa) River	13	219	From its origin (but not including source springs) to its confluence with Lake Mead.

ELKO COUNTY

Humboldt River	4	49	Its entire length in Elko County.
Maggie Creek	4	51	From its confluence with Jack Creek to the Humboldt River.

ESMERALDA COUNTY

Fish Lake	10	117	The entire lake.

EUREKA COUNTY

Humboldt River	4	52	Its entire length in Eureka County.
J. D. Ponds	4	53	The entire area.

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HUMBOLDT COUNTY

Water	HR	HA	Description of Area Classified
Humboldt River	4	64	The entire river in Humboldt County.
Little Humboldt River	4	67	Its entire length.

LANDER COUNTY

Reese River	4	56,58 59	North of Old U.S. Hwy 50.
Rock Creek	4	61,62 63	Below Squaw Valley Ranch.

LINCOLN COUNTY

Echo Canyon Reservoir	13	199	The entire reservoir.
Nesbitt Lake	13	209	The entire lake.
Pahranagat Reservoir	13	209	The entire reservoir.
Schroeder Reservoir	13	222	The entire reservoir.

LYON COUNTY

Mason Wildlife Area	9	108	All surface water impoundments.

MINERAL COUNTY

Weber Reservoir	9	110	Entire reservoir.
Walker River	9	110A	J.J. Ranch to Weber Reservoir
Walker River	9	110A	Weber Reservoir to Walker Lake

PERSHING COUNTY

Humboldt River	4	71,73	Its entire lenth in Pershing County.
Ryepatch Reservoir	4	77	The entire reservoir.

STOREY COUNTY

Water	HR	HA	Description of Area Classified
Tracy Pond	6	83	The entire area.

WASHOE COUNTY

Galena Creek	6	88	From gaging station number 10-348900 located in the SW¼SW¼ Section 2, T17N, R19E, MDB&M, to its confluence with Steamboat Creek.
Steamboat Creek	6	87,88 89	From Little Washoe Lake to gaging station number 10-349300 located in the S½ Section 33, T18N, R20E, MDB&M.
Truckee River	6	81	Ceresola Ranch to Pyramid Lake
Washoe Lakes	6	89	The entire lakes.

WHITE PINE COUNTY

Bassett Lake	10	179	The entire lake.
Comins Reservoir	10	179	The entire reservoir.
Duck Creek	10	179	From pump intake SE¼ Section 12, T18N, R63E, MDB&M to Bassett Lake.
Gleason Creek	10	179	From its origin to State Hwy 44.
Willow Reservoir	10	179	The entire reservoir.

4.2.4 *Class D Waters:* This classification includes waters or portions thereof located in areas of urban development, highly industrialized or intensively used for agriculture or combination of all the above and where effluent sources include a multiplicity of waste discharges from the highly altered watershed.

4.2.4.1 *Beneficial uses:* Agricultural use, boating and esthetics, and industrial supply except for food processing purposes.

4.2.4.2 *Quality Standards for Class D Waters:*

Items: 1. Floating solids, settleable solids; sludge deposits.

Specifications: Only such amounts attributable to the activities of man which will not impair the receiving waters for any beneficial use established for this class.

Items: 2. Sewage, industrial wastes or other wastes.

Specifications: None which are not effectively treated to the satisfaction of the Commission.

Items: 3. Critical material; oils; deleterious substances; colored or other wastes; or heated or cooled liquid.

Specifications: Only such amounts as will not impair the receiving waters for any beneficial use established by the Commission.

Item: 4. pH.

Specifications: Range between 6.0 and 9.0.

Item: 5. Dissolved oxygen.

Specifications: Not less than 3.0.

4.2.4.3 Table D reflects the waters classified as Class D Waters:

TABLE D

Class D Waters

HR - Hydrographic Region
HA - Hydrographic Area

CHURCHILL COUNTY

Water	HR	HA	Description of Area Classified
Stillwater Marsh	8	101	All that area of Stillwater Marsh not designated as Class C.

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STOREY COUNTY

Lagomarsino Creek	6	83	The entire length.

WASHOE COUNTY

Steamboat Creek	6	87	From gaging station number 10-349300 located in S½ Section 33, T18N, R20E, MDB&M, to its confluence with the Truckee River.

WHITE PINE COUNTY

Gleason Creek	10	179	From State Hwy 44 to confluence with Murray Creek.
Murray Creek	10	179	From its confluence with Gleason Creek to the south line of Section 32, T17N, R63E, MDB&M.

4.2.5 *Numerical water quality standards for selected waters of the state.*

Control Point – Control points are specific locations where water quality criteria are specified. Criteria so specified apply to all surface waters of Nevada in the watershed upstream from the control point, or to the next upstream control point or to the next water specifically named in Article 4.2. Where there are no control points downstream from a particular control point the criteria for that control point also apply to all surface waters of Nevada in the watershed downstream of the control point or to the next water specifically named in Article 4.2.

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